ATP

INDEX

Aircraft Technical Publishers
101 South Hill Drive
Brisbane, CA 94005

Customer Service
6AM-5PM PST M-F
(800)227-4610

ATP Grid Index to Manufacturer's Publications:

Collins
MKR-350, MKL-350/351, AUD-250/250H/251H, AMR-350/350H, GLS-3
Instruction Book

*** End of Index ***

MFG.

INTRO

523-0766031-10511A

Rockwell International

instruction book

Collins MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel
and
GLS-350/350E Glideslope Receiver

This instruction book includes:

Collins General Aviation Division
Avionics Group
Rockwell International
Cedar Rapids, Iowa 52498

Printed in the United States of America

Caution

The material in this manual is subject to change. Before attempting any maintenance operation on the equipment covered in this manual, verify that you have complete and up-to-date publications by referring to the applicable Publications and Service Bulletin Indexes.

We welcome your comments concerning this instruction book. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the instruction book part number, the paragraph or figure number, and the page number.

Send your comments to: Publications Department
Collins General Aviation Division
Rockwell International
Cedar Rapids, Iowa 52498

A

RECORD OF REVISIONS

MFG REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERTED BY
Errata	Installation Section:2-8	3/17/86	5/8/86	ATP/AO

RECORD OF TEMPORARY REVISIONS

TEMP REV NO	DESCRIPTION	ISSUE DATE	ATP REV DATE	INSERT BY	DATE REMOVED	REV INCOR	REMOVE BY

Collins Divisions
Cedar Rapids, Iowa 52498
(319) 395-1000
Cable COLINRAD Cedar Rapids

Rockwell
International

October 15, 1984

TO: HOLDERS OF MKR-350 MARKER RECEIVER, MKL-350/351 REMOTE MARKER LIGHTS, AUD-250/250H/251H AUDIO PANEL, AMR-350/350H AUDIO/MARKER PANEL AND GLS-350/350E GLIDESLOPE RECEIVER INSTRUCTION BOOK (523-0766031)

NEW EDITION HIGHLIGHTS

This edition completely replaces the existing book. A summary of the revisions is listed below.

Section	Description of Revision
MKR-350, MKL-350/351, AUD-250/250H/251H, AMR-350/350H section	
description	Added information for the AUD-251H -021 status.
installation	No change. (5th edition, June 9, 1982)
operation	No change. (5th edition, June 9, 1982)
theory	No change. (4th edition, June 9, 1982)
maintenance	Added test results for the AUD-251H -021 status.
diagrams	Added schematic diagram and parts lists for 628-6114-004 circuit board used on the -021 status of the AUD-251H.
bulletins	No change. (4th edition, June 9, 1982)
GLS-350/350H section	
description	No change. (4th edition, June 9, 1982)
installation	No change. (4th edition, June 9, 1982)
operation	No change. (3rd edition, June 9, 1982)
theory	No change. (3rd edition, June 9, 1982)
maintenance	Changed the wording of the test results in paragraph 5.5.1.3 to be consistent with a previous result.
diagrams	No change. (5th edition, June 9, 1982)
bulletins	No change. (4th edition, June 9, 1982)

28- to 14-volt adapter. Revised exploded view.

Portions of this book that have been revised are marked with a black bar in the margin. Pull your copies of service bulletins and service information letters from the bulletins sections of the old book and place them behind the bulletins section divider pages in the new book. Retain this letter of transmittal for future reference.

PUBLICATIONS DEPARTMENT

01

MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

S-TEC Corporation
TEC LINE Avionics

description

Printed in USA

523-0766036-106118
6th Edition, 9 June 1982
2 nd Revision, 27 May, 1992

table of contents

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL.
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None
2nd Ed	1 Sep 75		AMR-350/350H AUD-250/250H: SIL 1-75, 2-75; AMR-350H: SB 1
3rd Ed	15 Jun 76		Same as above
4th Ed	1 Jun 78		MKR-350: SB 1, 2, SIL 1-77, 2-77; AUD-250: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77, 2-77; AUD-250H: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77, 2-77; AUD-251H: SB 1, SIL 1-76; AMR-350: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77 [illegible] SB 1, 2, 3, 4, SIL 1-75, 2-75, 1-76, 1-77 thru 4-77
5th Ed	1 Aug 79		Preceding plus: AMR-350: SB 4, 5, SIL 1-79, 2-79; AMR-350H: SB 5, 6, SIL 1-79, 2-79; AUD-250H: SB 4; SIL 1-79; AUD-251H: SB 2, SIL 1-78; MKR-350: SB 3, AUD-250, SIL 1-79
6th Ed	9 Jun 82		Those above plus: MKR-350: SB 4, SIL 1-79; AUD-250H: SB 3R1; AUD-251H: SB 3R1, 4; AMR-350: SB 2R1, 5R1, 6, SIL 3-79; AMR-350H: SB 7, 8, SIL 3-79
1	30 Jul 84		Same as above
2	27 May 92		None

section I
description

1.1 INTRODUCTION

This instruction book contains all specifications, installation instructions, equipment operating procedures, principles of operation, and information necessary for proper maintenance of the MKR-350 Marker Receiver, MKL-350/351 Remote Marker Lights, AUD-250/250H/251H Audio Panel, and AMR-350/350H Audio/Marker Panel.
Table 1-1 lists the equipment included in this instruction book by Collins part number and provides a brief description of each unit. A detailed description of each unit as well as its function in an operating system are described in paragraph 1.2.

1.2 PURPOSE OF THE EQUIPMENT

1.2.1 MKR-350 Marker Receiver

The MKR-350 Marker Receiver provides accurate distance fixes relative to the runway. Both visual and aural indications are provided upon passage of a marker beacon station.

1.2.2 MKL-350/351 Remote Marker Lights

The MKL-350/351 Remote Marker Lights unit is a remotely mounted marker light unit that operates in conjunction with the AMR-350/350H Audio/Marker Panel or MKR-350 Marker Receiver. The MKL-350/351 provides the pilot with visual indication of marker beacon passage.

Note

The MKL-350 is no longer in production; this unit has been replaced by the MKL-351 Remote Marker Lights.

1.2.3 AUD-250/250H Audio Panel

The AUD-250/250H Audio Panel is a panel-mounted unit providing the functions of audio control panel and isolation amplifier.

1.2.4 AUD-251H Audio Panel

The AUD-251H Audio Panel provides isolation amplification, audio switching, and intercom functions. The AUD-251H is designed for use in aircraft in which intercommunication between crew members is required, or in which isolation between headphone inputs is desired.

1.2.5 AMR-350/350H Audio/Marker Panel

The AMR-350/350H Audio/Marker Panel is a panel-mounted unit providing the functions of marker beacon receiver, audio control panel, and isolation amplifier.

1.3 DESIGN FEATURES

1.3.1 MKR-350 Marker Receiver

- Automatic display dimming to adapt to any cockpit lighting conditions.
- Dual gate MOSFET rf amplifier to provide maximum sensitivity and freedom from spurious response.
- Crystal filter selectivity to ensure maximum rejection of adjacent channel interference.
- Complete solid-state circuitry.
- Front panel mounting, horizontal or vertical, for ease of installation.
- Human engineered for maximum visibility and ease of use.
- Distinctive styling coordinated with other Collins General Aviation Division avionics.

1.3.2 MKL-351 Remote Marker Lights

- Front panel mounting for ease of installation.
- Human engineered for maximum visibility and ease of use.
- Distinctive styling coordinated with other Collins General Aviation Division avionics.

Table 1-1. Equipment Part Number/Description Matrix.

PART NUMBER STATUS	AUD-250 AUDIO PANEL 622-2088	AUD-250H AUDIO PANEL 622-2463	AUD-251H AUDIO PANEL 622-3101	AMR-350 AUDIO/ MARKER PANEL 622-2087	AMR-350H AUDIO/ MARKER PANEL 622-2462	MKR-350 MARKER RECEIVER 622-2085	MKL-350 REMOTE MARKER LIGHTS 622-2086	MKL-351 REMOTE MARKER LIGHTS 622-3102
-001	Black panel, flat metal switches.	Black panel, flat metal switches.	Black panel, flat plastic switches.	Black panel, flat metal switches (COM 1/ COM 2/ EXT).	Black panel, flat metal switches.	Black panel, high and low sensitivity, automatic lamp dimming, lamp test switch.	No longer in production.	Black panel, horizontal or vertical mounting, size: 38 mm (1.5 in) x 25.4 mm (1.0 in).
-002	Blue panel, flat metal switches.	Blue panel, flat metal switches.	Blue panel, flat plastic switches.	Blue panel, flat metal switches (COM 1/ COM 2/ EXT).	Blue panel, flat metal switches.	NA		NA
-003	Green panel, flat metal switches.	Green panel, flat metal switches.	Green panel, flat plastic switches.	Green panel, flat metal switches (COM 1/ COM 2/ EXT).	Green panel, flat metal switches.	NA		NA
-004	Red panel, flat metal switches.	Red panel, flat metal switches.	Red panel, flat plastic switches.	Red panel, flat metal switches (COM 1/ COM 2/ EXT).	Red panel, flat metal switches.	NA		NA
-005	Brown panel, flat metal switches.	Brown panel, flat metal switches.	Brown panel, flat plastic switches.	Brown panel, flat metal switches (COM 1/ COM 2/ EXT).	Brown panel, flat metal switches.	NA		NA
-006	NA	NA	Grey panel, flat plastic switches.	Black panel, flat metal switches (COM 1/ COM 2/ PA).	NA	NA		NA

Table 1-1. Equipment Part Number/Description Matrix (Cont).

PART NUMBER STATUS	AUD-250 AUDIO PANEL 622-2088	AUD-250H AUDIO PANEL 622-2463	AUD-251H AUDIO PANEL 622-3101	AMR-350 AUDIO/ MARKER PANEL 622-2087	AMR-350H AUDIO/ MARKER PANEL 622-2462	MKR-350 MARKER RECEIVER 622-2085	MKL-350 REMOTE MARKER LIGHTS 622-2086	MKL-351 REMOTE MARKER LIGHTS 622-3102
-007	NA	NA	NA	NA	NA	NA		NA
-008	NA	NA	NA	NA	NA	NA		NA
-009	NA	NA	NA	NA	NA	NA		NA
-010	NA	NA	NA	NA	NA	NA		NA
-011	Black panel, round switches.	Black panel, round switches.	Black panel, round switches.	Black panel, round switches (COM 1/ COM 2/ EXT).	Black panel, round switches.	NA		NA
-012	Blue panel, round switches.	Blue panel, round switches.	Blue panel, round switches.	Blue panel, round switches (COM 1/ COM 2/ EXT).	Blue panel, round switches.	NA		NA
-013	Green panel, round switches.	Green panel, round switches.	Green panel, round switches.	Green panel, round switches (COM 1/ COM 2/ EXT).	Green panel, round switches.	NA		NA
-014	Red panel, round switches.	Red panel, round switches.	Red panel, round switches.	Red panel, round switches (COM 1/ COM 2/ EXT).	Red panel, round switches.	NA		NA
-015	Brown panel, round switches.	Brown panel, round switches.	Brown panel, round switches.	Brown panel, round switches (COM 1/ COM 2/ EXT).	Brown panel, round switches.	NA		NA
-016	Grey panel, flat plastic switches.	Grey panel, flat plastic switches	Grey panel, round switches.	Black panel, round switches (COM 1/ COM 2/ PA).	Grey panel, flat plastic switches.	NA		NA

Table 1-1. Equipment Part Number/Description Matrix (Cont).

PART NUMBER STATUS	AUD-250 AUDIO PANEL 622-2088	AUD-250H AUDIO PANEL 622-2463	AUD-251H AUDIO PANEL 622-3101	AMR-350 AUDIO/ MARKER PANEL 622-2087	AMR-350H AUDIO/ MARKER PANEL 622-2462	MKR-350 MARKER RECEIVER 622-2085	MKL-350 REMOTE MARKER LIGHTS 622-2086	MKL-351 REMOTE MARKER LIGHTS 622-3102
-017	Grey panel, round switches.	Grey panel, round switches.	NA	Grey panel, flat plastic switches (COM 1/ COM 2/ EXT).	Grey panel, round switches.	NA		NA
-018	NA	NA	NA	Grey panel, round switches (COM 1/ COM 2/ EXT).	Black panel, flat metal switches	NA		NA
-019	NA	NA	NA	Blue panel, flat plastic switches (COM 1/ COM 2/ PA).	NA	NA		NA
-020	NA	NA	NA	Green panel, flat plastic switches (COM 1/ COM 2/ PA).	NA	NA		NA
-021	NA	NA	Black panel, flat plastic switches. 60 dB of isolation between inputs.	Red panel, flat plastic switches (COM 1/ COM 2/ PA).	NA	NA		NA
-022	NA	NA	NA	Brown panel, flat plastic switches (COM 1/ COM 2/ PA).	NA	NA		NA

Table 1-1. Equipment Part Number/Description Matrix (Cont).

PART NUMBER STATUS	AUD-250 AUDIO PANEL 622-2088	AUD-250H AUDIO PANEL 622-2463	AUD-251H AUDIO PANEL 622-3101	AMR-350 AUDIO/ MARKER PANEL 622-2087	AMR-350H AUDIO/ MARKER PANEL 622-2462	MKR-350 MARKER RECEIVER 622-2085	MKL-350 REMOTE MARKER LIGHTS 622-2086	MKL-351 REMOTE MARKER LIGHTS 622-3102
-023	NA	NA	NA	Grey panel, flat plastic switches (COM 1/ COM 2/ PA).	NA	NA		NA
-024	NA	NA	NA	Blue panel, round switches (COM 1/ COM 2/ PA).	NA	NA		NA
-025	NA	NA	NA	Green panel, round switches (COM 1/ COM 2/ PA).	NA	NA		NA
-026	NA	NA	NA	Red panel, round switches (COM 1/ COM 2/ PA).	NA	NA		NA
-027	NA	NA	NA	Brown panel, round switches (COM 1/ COM 2/ PA).	NA	NA		NA
-028	NA	NA	NA	Grey panel, round switches (COM 1/ COM 2/ PA).	NA	NA		NA

1.3.3 AUD-250/250H Audio Panel

- AUTO switch to simplify switching functions.
- Independent audio control of NAV and COMM.
- Automatic muting circuitry to prevent acoustical feedback when transmitter is keyed.
- Human engineered for maximum visibility and ease of use.
- Distinctive styling coordinated with other Collins General Aviation Division avionics.
- Available in an international version with an input for an hf transceiver.
- Contemporary design color keyed to aircraft instrumentation panel.

1.3.4 AUD-251H Audio Panel

- AUTO control to reduce switching.
- Automatic muting to prevent acoustical feedback when a transmitter is keyed.
- Five-station intercom capability.
- Isolation and amplification of headphone inputs.
- Separate power inputs for headphone and speaker amplifiers to ensure use of all avionics in the event of an amplifier failure.
- Human engineered for maximum visibility and ease of use.
- Distinctive styling coordinated with other Collins General Aviation Division avionics.

1.3.5 AMR-350/350H Audio/Marker Panel

- AUTO switch to simplify switching functions.
- Independent audio control of NAV and COMM.
- Automatic dimming of marker lights to adapt to all cockpit lighting conditions.
- Marker receiver HIGH and LOW sensitivity control for enroute and approach flight.
- Automatic muting circuitry to prevent acoustical feedback when the transmitter is keyed.
- Human engineered for maximum visibility and ease of use.
- Distinctive styling coordinated with other Collins General Aviation Division avionics.
- Available in an international version with an input for an hf transceiver.

1.4 EQUIPMENT SPECIFICATIONS

Tables 1-2 through 1-7 list the equipment specifications of the MKR-350, MKL-350/351, AUD-250/250H/251H, and AMR-350/350H respectively.

1.5 EQUIPMENT SUPPLIED

1.5.1 MKR-350 Marker Receiver

Supplied with the MKR-350 Marker Receiver (CPN 622-2085-001) is an installation kit (CPN 628-7631-001). Figure 2-1, shown in the installation section of this instruction book, provides an exploded view of the kit and a list of materials contained within the kit.

1.5.2 MKL-350/351 Remote Marker Lights

Supplied with the MKL-350 Remote Marker Lights (CPN 622-2086-001) and the MKL-351 Remote Marker Lights (CPN 622-3102-001) is an installation kit (CPN 628-7632-001). Figure 2-2, shown in the installation section of this instruction book, provides an exploded view of the kit and a list of materials contained within the kit.

1.5.3 AUD-250/250H/251H Audio Panel

Supplied with the AUD-250 (CPN 622-2088-XXX), AUD-250H (CPN 622-2463-XXX), and AUD-251H (CPN 622-3101-001) Audio Panels is an installation kit (CPN 628-7633-001). Figure 2-5, shown in the installation section of this book, provides an exploded view of the kit and a list of the materials contained within the kit.

1.5.4 AMR-350/350H Audio/Marker Panel

Supplied with the AMR-350 (CPN 622-2087-XXX) and AMR-350H (CPN 622-2462-XXX) Audio/Marker Panels is an installation kit (CPN 628-7633-001). Figure 2-6 in the installation section of this book provides an exploded view of the kit and a list of the materials contained within the kit.

Table 1-2. MKR-350 Marker Receiver, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Related documents	
FAA TSO	-C35d, class A, category DAPBAAEXXXXX DO 138.
Physical	
Dimensions	
Front panel	
Height	26.40 mm (1.039 in).
Width	81.00 mm (3.189 in).
Chassis	
Height	29.00 mm (1.142 in).
Width	81.00 mm (3.189 in).
Rear extension	165.10 mm (6.500 in) maximum including mating connector and cable relief.
Mounting	Panel mounted, no tray required.
Weight	0.30 kg (0.65 lb) maximum.
Environmental	
Temperature range	
Continuous	-15 to +55 °C (+5 to +131 °F).
Intermittent	To +71 °C (+159.8 °F) for 30 minutes.
Storage	To +85 °C (+185 °F).
Altitude	9144 m (30 000 ft) operational.
Cooling	Convection.
Relative humidity	95% at +50 °C (+122 °F).
Shock	
Operational	6 g.
Crash safety	15 g (10 ms duration).
Electrical	
Power requirements	13.75 V dc, 0.22 A (one lamp actuated). 27.5 V dc, 0.255 A (one lamp actuated).
Frequency stability	±0.005 percent.
Sensitivity	
High	200 µV 95 percent modulated.
Low	1000 µV 95 percent modulated.
Selectivity	
6-dB response	Not more than ±40 kHz, not less than ±10 kHz.
60-dB response	Not more than ±250 kHz.
Rf input impedance	50 ohms.
AGC	Not more than 8-dB af output variation from lamp threshold to 200 000-µV input.
Audio output	5 mW into a 500-ohm load.
Audio distortion	Not more than 20 percent at 5 mW output.
Audio response	Not more than 6-dB variation for the following ranges: 380 to 420 Hz, 1235 to 1365 Hz, 2850 to 3150 Hz.
Lamp frequency response	Not more than 6-dB variation when modulation is varied from: 390 to 410 Hz, 1270 to 1330 Hz, 2920 to 3080 Hz.

Table 1-2. MKR-350 Marker Receiver, Equipment Specifications (Cont).

CHARACTERISTICS	SPECIFICATIONS
CAUTION Marker lamp outputs available at unit rear connector are intended for use with remote marker lights only. Do not use middle marker lamp voltage to activate glideslope gain change in an autopilot. Because of lamp dimmer circuit operation, it is possible that the voltage across the middle marker lamp could trigger an unwanted gain change when passing over the outer marker.	

Table 1-3. MKL-350 Remote Marker Lights, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Related documents	
FAA TSO	-C35d; category A; DAPBAAXXXXXX DO 138.
Physical	
Dimensions	
Front panel	
Height	26.67 mm (1.050 in).
Width	81.28 mm (3.200 in).
Chassis	
Height	26.67 mm (1.050 in) maximum.
Width	81.28 mm (3.200 in) maximum.
Rear extension	62.20 mm (2.450 in) maximum including mating connector and cable relief.
Mounting	Panel mounted, no tray required.
Weight	0.11 kg (0.25 lb).
Power requirements	Power supplied by AMR-350/350H Audio/Marker Panel.
Indicators	
Lamps	Blue (O) actuated by a received 400-Hz tone. Amber (M) actuated by a received 1300-Hz tone. White (I) actuated by a received 3000-Hz tone.

Table 1-4. MKL-351 Remote Marker Lights, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Related documents	
FAA TSO	-C35d, class A, category DAPBAAEXXXXX DO 138.
Physical	
Dimensions	
Front panel	
Height	26.4 mm (1.039 in).
Width	38.1 mm (1.50 in).
Chassis	
Height	26.67 mm (1.05 in) maximum.
Width	40.0 mm (1.575 in) maximum.
Rear extension	70.0 mm (2.70 in) maximum including mating connector and cable relief.
Mounting	Panel mounted, no tray required.
Weight	0.07 kg (0.15 lb).
Environmental	
Temperature range	
Continuous	-15 to +55 °C (+5 to +131 °F).
Intermittent	To +71 °C (+159.8 °F) for 30 minutes.
Storage	To +85 °C (+185 °F).
Altitude	9144 m (30 000 ft) operational.
Cooling	Convection.
Relative humidity	95% at +50 °C (+122 °F).
Shock	
Operational	6 g.
Crash safety	15 g (10 ms duration).
Electrical	
Power requirements	Power supplied by AMR-350/350H Audio/Marker Panel or MKR-350 Marker Receiver.
Indicators	
Lamps	Blue (O) actuated by a received 400-Hz tone. Amber (M) actuated by a received 1300-Hz tone. White (I) actuated by a received 3000-Hz tone.

Table 1-5. AUD-250/250H Audio Panel, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Related documents	
FAA TSO	-C50b; category DAPBAAEXXXXX DO 138.
Physical	
Dimensions	
Front panel	
Height	38.10 mm (1.50 in)
Width	158.8 mm (6.25 in).
Chassis	
Height	38.35 mm (1.51 in) maximum.
Width	160.27 mm (6.31 in) maximum.
Rear extension	142.00 mm (5.59 in) maximum including mating connector and cable relief.
Weight	0.68 kg (1.5 lb).
Mounting	Panel mounted. Mounting tray (CPN 628-7639-001) supplied with unit is required for mounting.
Environmental	
Temperature range	-15 to +55 °C (+5 to +131 °F).
Continuous	To +71 °C (+159.8 °F) for 30 minutes.
Intermittent	To +85 °C (+185 °F).
Storage	9,144 m (30,000 ft) operational.
Altitude	Convection.
Cooling	95% at +50 °C (+122 °F).
Relative humidity	
Shock	6 g.
Operational	15 g (10 ms duration).
Crash safety	
Electrical	13.75 V dc, 1.1 A maximum.
Power requirements	Not less than 5 W.
Power output	Two transceivers, five separate receivers.
Inputs	500 ohms.
Input impedance	Not less than 40 dB.
Isolation between inputs	3-dB variation maximum from 350 to 3000 Hz.
Frequency response	Not more than 10 percent at 5 W; not more than 5 percent at 2.5 W.
Harmonic distortion	
	Not less than 40 dB below rated output. All switches in off position.
Audio signal-to-noise ratio (no inputs)	

Table 1-6. AUD-251H Audio Panel, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Related documents	
FAA TSO	-C50b; category DAPBAXEXXXXX DO-138
Physical	
Dimensions	
Front panel	
Height	38.10 mm (1.50 in).
Width	158.8 mm (6.25 in).
Chassis	
Height	38.35 mm (1.51 in) maximum.
Width	160.27 mm (6.31 in) maximum.
Rear extension	142.00 mm (5.59 in) maximum, including mating connector and cable relief.
Weight	0.68 kg (1.5 lb).
Mounting	Panel mounted. Mounting kit (cpn 628-7633-001) supplied with unit is required for mounting.
Environmental	
Temperature range	
Continuous	-15 to +55 °C (+5 to +131 °F).
Intermittent	To +71 °C (+160 °F) for 30 minutes.
Storage	To +85 °C (+185 °f).
Altitude	9144 m (30 000 ft) operating.
Cooling	Convection.
Relative humidity	95% at +50 °C (+122 °F).
Shock	
Operational	6 g.
Crash safety	15 g (10-ms duration).
Electrical	
Power requirements	
Speaker amplifier	13.75 V dc 1.1 A nominal at 5 watts power out. 1.5 A maximum with 5 volts rms. 1 kHz tone input.
Headphone amplifier	13.75 V dc, 0.35 A maximum.

Table 1-6. AUD-251H Audio Panel, Equipment Specifications (Cont)

CHARACTERISTICS	SPECIFICATIONS
Inputs	Three transceivers, five separate receivers.
Input impedance	500 ohms.
Isolation between inputs	Not less than 40 dB. (622-3101-021, not less than 60 dB.)
Speaker output	Not less than 5 W.
Headphone output	Not less than 8 V rms. (622-3101-021, not less than 5 V rms.)
Headphone loads	Up to five standard 500-ohm headsets.
Frequency response	3-dB variation maximum from 350 to 3000 Hz.
Harmonic distortion	
Speaker	Not more than 10% at 5 W; not more than 5% at 2.5 W.
Headphone	Not more than 10% at 5 V rms. (622-3101-021, at 5 V rms.)
Audio signal-to-noise ratio (no inputs)	Not less than 40 dB below rated output. All switches in off position.

Table 1-7. AMR-350/350H Audio/Marker Panel, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Related documents	
FAA TSO	-C35d, category A; -C50b, category DAPBAAEXXXXX DO 138.
Physical	
Dimensions	
Front panel	
Height	38.10 mm (1.50 in).
Width	158.8 mm (6.25 in).
Chassis	
Height	38.35 mm (1.51 in) maximum.
Width	160.27 mm (6.31 in) maximum.
Rear extension	142.00 mm (5.59 in) maximum including mating connector and cable relief.
Mounting	
Panel mounted	Mounting tray required (CPN 628-7639-001) is supplied with unit.
Weight	0.82 kg (1.8 lb) maximum.

Table 1-7. AMR-350/350H Audio/Marker Panel Equipment Specifications (Cont).

CHARACTERISTICS	SPECIFICATIONS
Environmental	
Temperature range	
Continuous	-15 to +55 °C (+5 to +131 °F).
Intermittent	To +71 °C (+159.8 °F) for 30 minutes.
Storage	To +85 °C (+185 °F).
Altitude	9,144 m (30,000 ft) operational.
Cooling	Convection.
Relative humidity	95% at +50 °C (+122 °F).
Shock	
Operational	6 g.
Crash safety	15 g (10 ms duration).
Electrical	
Power requirements	13.75 V dc, 1.1 A maximum. 27.5 V dc, 1.1 A maximum.
Power output	Not less than 5 W.
Inputs	Two transceivers, four separate receivers, and internal marker receiver.
Input impedance	500 ohms ±10 percent.
Isolation between inputs	Not less than 40 dB.
Frequency response	350 to 3000 Hz, 3-dB variation maximum.
Harmonic distortion	Not more than 10 percent at 5 W; not more than 5 percent at 2.5 W.
Audio signal-to-noise ratio (no inputs)	Not less than 40 dB below rated output. All switches in off position.
Frequency stability	±0.005 percent.
Sensitivity	
High	200 μV 95 percent modulated.
Low	1000 μV 95 percent modulated.
Selectivity	
6-dB response	Not more than ±40 kHz, not less than ±10 kHz.
60-dB response	Not more than ±250 kHz.
Rf input impedance	50 ohms.
AGC	Not more than 8-dB af output variation from lamp threshold to 200,000-μV input.

Table 1-7. AMR-350/350H Audio/Marker Panel, Equipment Specifications (Cont).

CHARACTERISTICS	SPECIFICATIONS
Audio output	5 mW into a 500-ohm load.
Audio distortion	Not more than 20 percent at 5-mW output.
Audio response	Not more than 6-dB variation for the following ranges: 380 to 420 Hz, 1235 to 1365 Hz, 2850 to 3150 Hz.
Lamp frequency response	Not more than 6-dB variation when modulation is varied from: 390 to 410 Hz, 1270 to 1330 Hz, 2920 to 3080 Hz.

CAUTION

Marker lamp outputs available at unit rear connector are intended for use with remote marker lights only. Do not use middle marker lamp voltage to activate glideslope gain change in an autopilot. Because of lamp dimmer circuit operation, it is possible that the voltage across the middle marker lamp could trigger an unwanted gain change when passing over the outer marker.

1.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The following equipment is required for proper operation of the equipment but is not supplied.

1.6.1 MKR-350 Marker Receiver

a. Marker beacon antenna
b. Interconnecting cables

1.6.2 MKL-350/351 Remote Marker Lights

a. MKR-350 Marker Receiver or AMR-350/350H Audio/Marker Panel
b. Interconnecting cables

1.6.3 AUD-250/250H Audio Panel

a. Interconnecting cables

Note

If the AUD-250/250H Audio Panel is to be installed in a 28-volt system, a Collins 28- to 14-V dc Adapter (CPN 628-7990-001), or equivalent, is required for operation.

1.6.4 AUD-251H Audio Panel

All equipment required for proper operation of the AUD-251H Audio Panel is supplied with the unit. Interconnecting cables must be provided by the system installer.

Note

The AUD-251H Audio Panel is designed to operate in a 14-volt system. If installed in a 28-volt system, two Collins 28- to 14-V dc Adapters (CPN 628-7990-001), or equivalent, are required for operation.

1.6.5 AMR-350/350H Audio/Marker Panel

a. Marker beacon antenna
b. Interconnecting cables

Note

If the AMR-350/350H Audio/Marker Panel is used in a 28-volt system, a Collins 28- to 14-V dc Adapter (CPN 628-7990-001), or equivalent, is required for operation.

Collins MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

Rockwell International

installation

Collins General Aviation Division

Printed in USA

523-0766037-005118
5th Edition, 9 June 1982

table of contents

NOTICE: This section replaces fourth edition dated 1 June 1978.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None
2nd Ed	1 Sep 75		AMR-350/350H AUD-250/250H: SIL 1-75, 2-75; AMR-350: SB 1
3rd Ed	15 Jun 76		Same as above
4th Ed	1 Jun 78		MKR-350: SB 1, 2, SIL 1-77, 2-77; AUD-250: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77, 2-77; AUD-250H: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77, 2-77; AUD-251H: SB 1, SIL 1-76; AMR-350: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77 thru 4-77; AMR-350H: SB 1, 2, 3, 4, SIL 1-75, 2-75, 1-76, 1-77 thru 4-77
5th Ed	9 Jun 82		Those above plus: MKR-350: SB 3, 4, SIL 1-79; AUD-250: SIL 1-79; AUD-250H: SB 3R1, 4, SIL 1-79; AUD-251H: SB 2, 3R1, 4, SIL 1-78; AMR-350: SB 2R1, 4, 5R1, 6, SIL 1-79, 2-79, 3-79; AMR-350H: SB 5, 6, 7, 8, SIL 1-79, 2-79, 3-79

2.1 GENERAL

This system contains all information necessary to install the MKR-350, MKL-350/351, AUD-250/250H/251H, and AMR-350/350H units into an aircraft, and to ensure their operational readiness after installation.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Unpack the equipment carefully and make a careful visual inspection of each unit for possible shipping damage. All claims for damage should be filed with the transportation company involved. If claims for damage are to be filed, save the original packing carton and materials. If no defects can be detected, replace packing materials in the shipping container and save for future uses such as storage or reshipment.

2.3 SPECIAL INSTRUCTIONS

2.3.1 MKR-350, MKL-350/351, AUD-250/250H, and AMR-350/350H

There are no special instructions to be followed when installing the MKR-350, MKL-350/351, AUD-250/250H, or AMR-350/350H units. Refer to paragraph 2.4 for installation procedures.

2.3.2 AUD-251H

The AUD-251H contains independent speaker and headphone amplifiers and two independent regulating power supplies. For fail-safe operation, connect J101 pin 2 and J101 pin 10 to the aircraft power bus through separate circuit breakers. Following this procedure ensures full use of all avionics equipment in the event of an amplifier failure.

2.4 INSTALLATION PROCEDURES

The following installation procedures must be performed as described to ensure proper operation and performance. Any deviation from these instructions may result in reduced performance and/or damage to the equipment.

2.4.1 MKR-350 and MKL-350/351

The installation kits supplied with the MKR-350 and MKL-351 are required for unit installation. Refer to figures 2-1, 2-2, and 2-3.

Both the MKR-350 and MKL-350 are panel-mounted units that may be positioned horizontally or vertically. If vertical mounting is desired, the lens provided in the installation kit (CPN 628-7561-002) must be substituted. No alterations to the equipment are necessary for conversion to the vertical lens.

a. Refer to figures 2-4, 2-5, and 2-6 for outline and mounting dimensions of the MKR-350, MKL-350, and MKL-351.
b. After location is determined, make the panel cutout using the outline and mounting drawings as reference.
c. Secure the MKR-350 and MKL-350 to the aircraft instrumentation panel using four #4-40 screws. The MKL-351 is secured in position using two #4-40 screws.

2.4.2 AUD-250/250H/251H Audio Panel

The AUD-250/250H/251H Audio Panel is a panel-mounted unit that is rigidly attached to the aircraft instrumentation panel. The installation kit (CPN 628-7633-001) supplied with the AUD-250/250H/251H is required for installation. Refer to figure 2-7. If the AUD-250/250H is to be used in a 27.5-volt installation, an adapter kit (CPN 628-7990-001) is required. Operation of the AUD-251H in a +27.5-V system also requires two power conversion kits. If required, order CPN 628-7990-001.

a. Figure 2-9 is the outline and mounting drawing of the AUD-250/250H/251H Audio Panel. Using the dimensions provided, make the panel cutout and drill the four holes needed to secure the equipment cover (mounting tray) to the aircraft panel mounting brackets. Use four #6 screws to secure the tray in position.
b. After the equipment cover has been installed, slide the AUD-250/250H/251H into position and secure in place by tightening the locking screw. A 5/64-inch Allen wrench is required for locking.

Note

The following steps pertain to the AUD-251H only.

c. If independent control of headset audio is desired, connect a 500-ohm L-pad between the AUD-251H and the headset. The L-pad constant impedance side should be connected to the AUD-251H, and the nonconstant to the headset. One L-pad should be used on each headset.

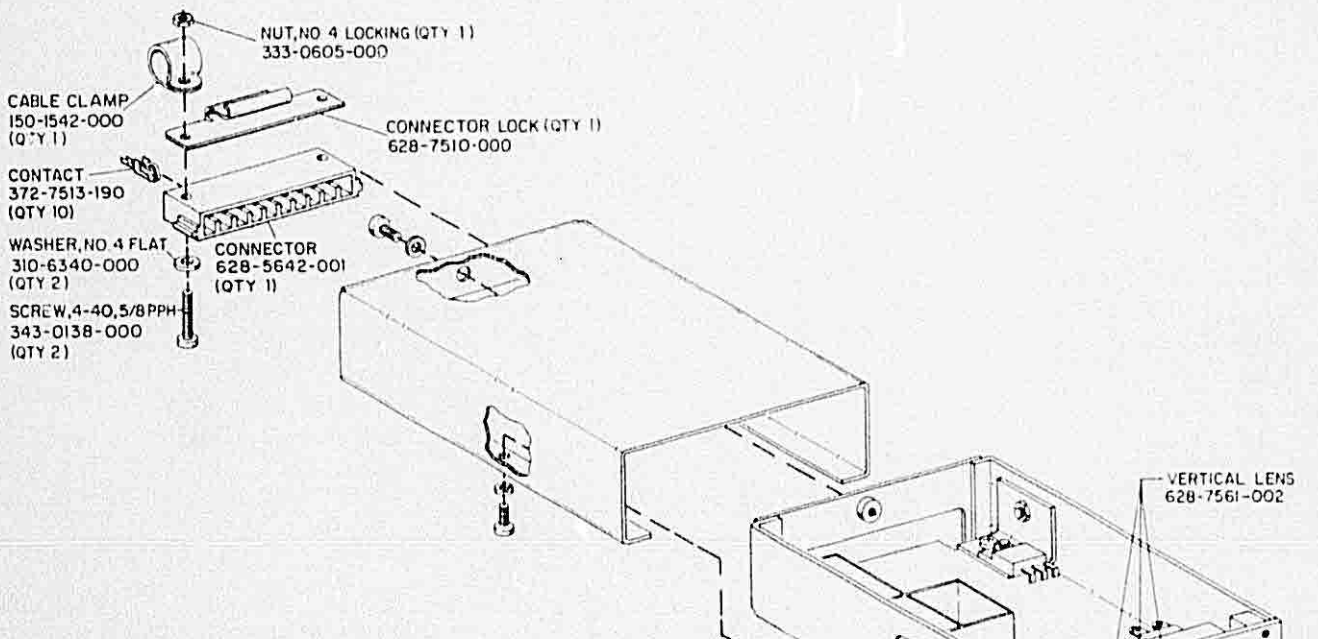
d. Aircraft microphone switching must be planned carefully to ensure connection is made to ICS microphone input only when an ICS switch is actuated. This is especially important in a boom microphone installation in which keying switches are located in the yoke. Switches should be plainly labeled.

2.1.3 AMR-350/350H Audio/Marker Panel

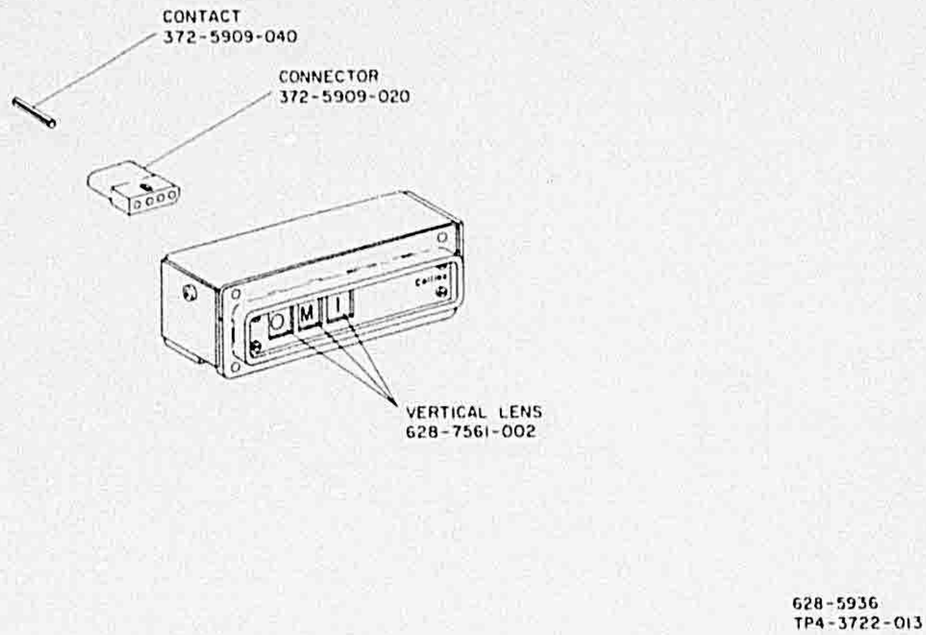
a. The AMR-350/350H is a panel-mounted unit that is rigidly attached to the aircraft instrumentation panel. The installation kit (CPN 628-7633-001) supplied with the AMR-350/350H is required for installation. Refer to figure 2-8. If the AMR-350/350H is to be used in a +27.5-volt installation, an adapter kit (CPN 628-7990-001) is required. Using the materials included in the kit, attach the power resistor to a bulkhead or convenient location away from radios. If a suitable location cannot be found, attach the conversion kit to the mounting tray. The resistor is connected in series with the primary power input line.

b. Figure 2-9 is the outline and mounting drawing of the AMR-350/350H. Using the dimensions provided, make the panel cutout and drill the four holes needed to secure the equipment cover (mounting tray) to the aircraft panel mounting bracket.

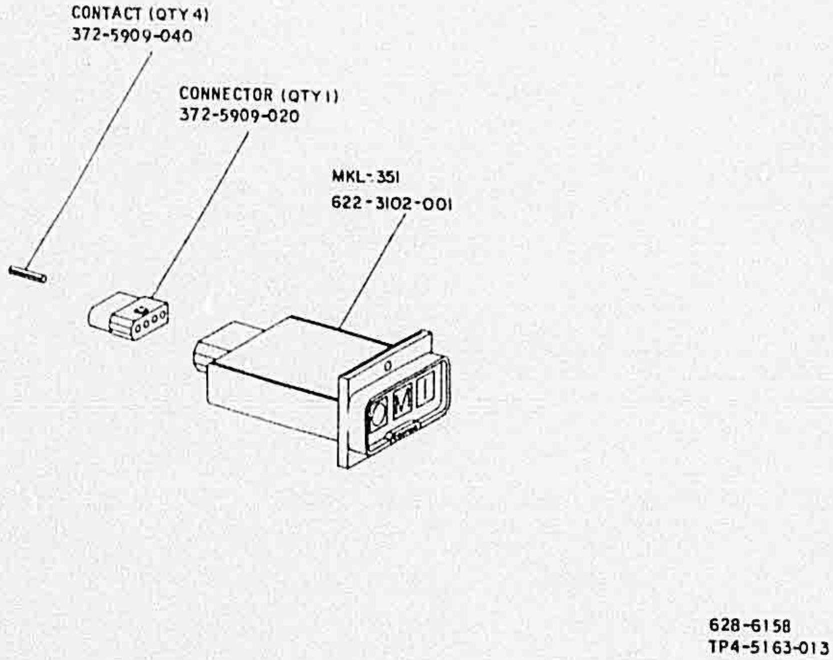
c. After the equipment cover has been installed, slide the AMR-350/350H into position and secure in place by tightening the locking screw. A 5/64-inch Allen wrench is required for locking.



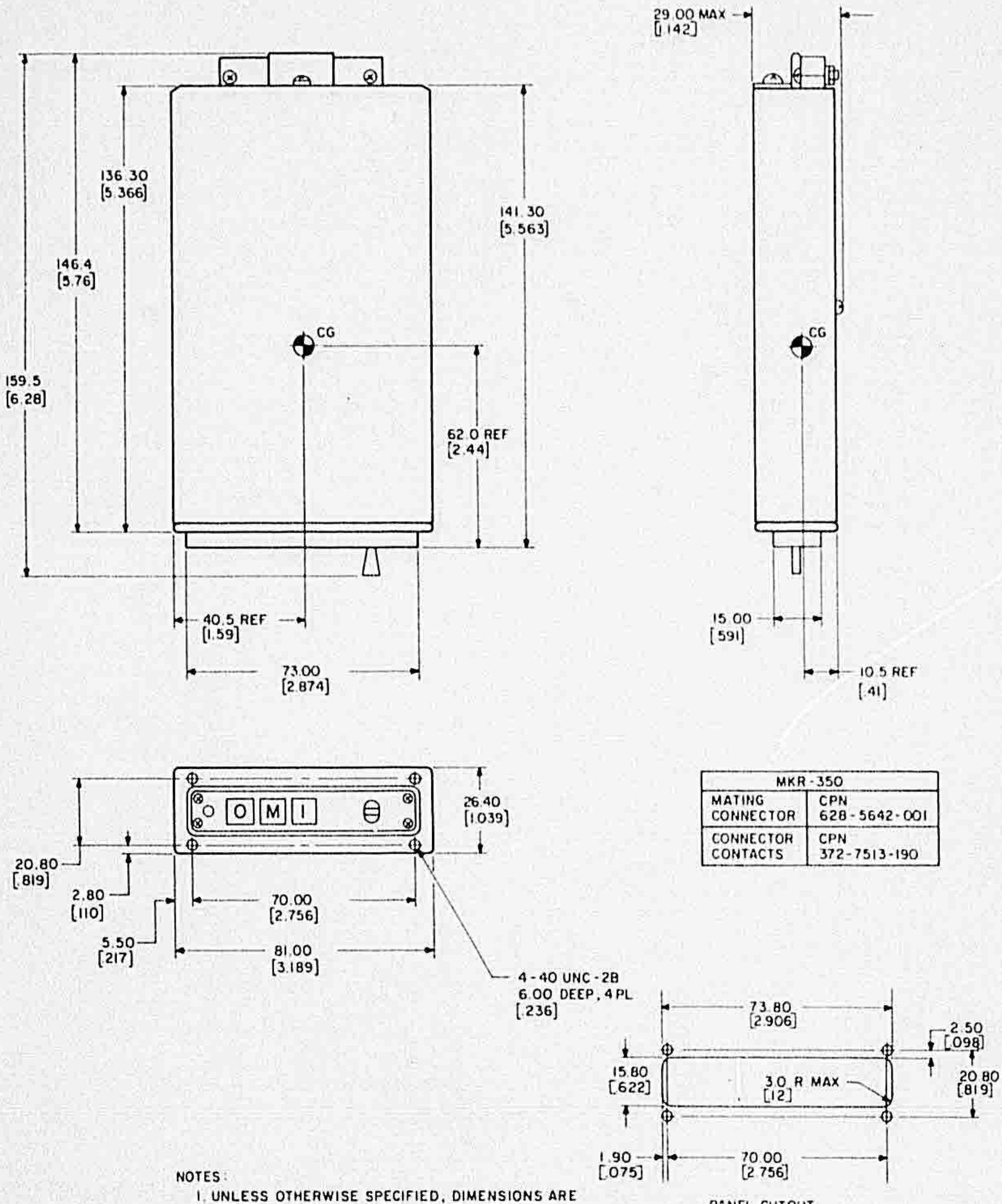
MKR-350 Marker Receiver, Installation Kit
Figure 2-1



MKL-350 Remote Marker Lights, Installation Kit
Figure 2-2



MKL-351 Remote Marker Lights, Installation Kit
Figure 2-3



MKR-350	
MATING CONNECTOR	CPN 628-5642-001
CONNECTOR CONTACTS	CPN 372-7513-190

NOTES:

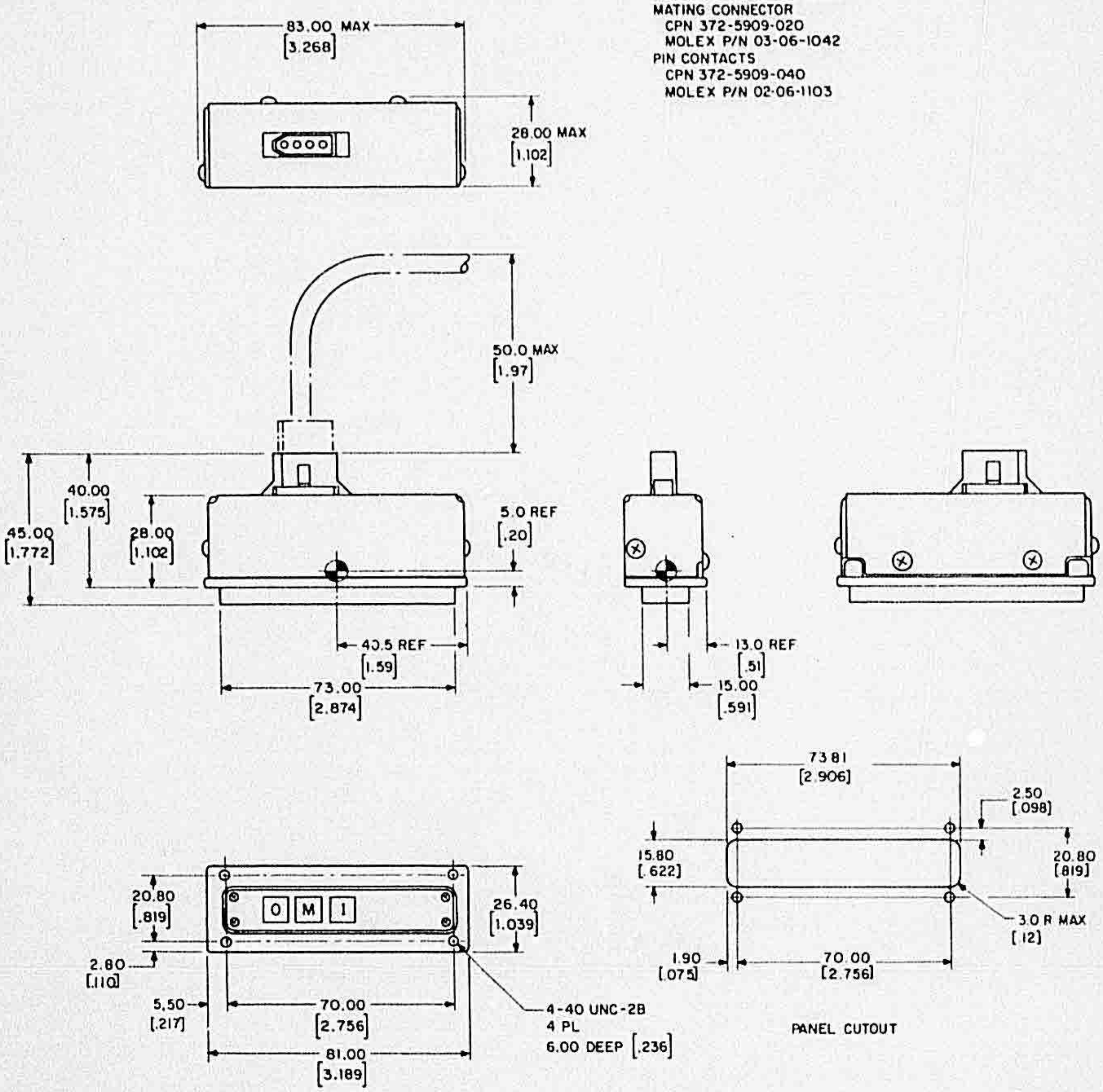
1. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm [INCHES].
2. WEIGHT: 0.30 kg MAX [.65 LBS].

628-5704
TP4-2079-014

MKR-350 Marker Receiver, Outline and Mounting Dimensions
Figure 2-4

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES, [INCHES].
2. UNIT WEIGHT: 0.113 kg, MAX; .250 LBS, MAX.
3. CONNECTOR INFORMATION:
   CPN 372-5909-430
   MOLEX P/N 03-06-2041
   PIN CONTACTS
   CPN 372-5909-070
   MOLEX P/N 02-06-2132
   MATING CONNECTOR
   CPN 372-5909-020
   MOLEX P/N 03-06-1042
   PIN CONTACTS
   CPN 372-5909-040
   MOLEX P/N 02-06-1103



628-5702
TP4-2077-014

MKL-350 Remote Marker Lights, Outline and Mounting Dimensions
Figure 2-5

2.5 CABLING

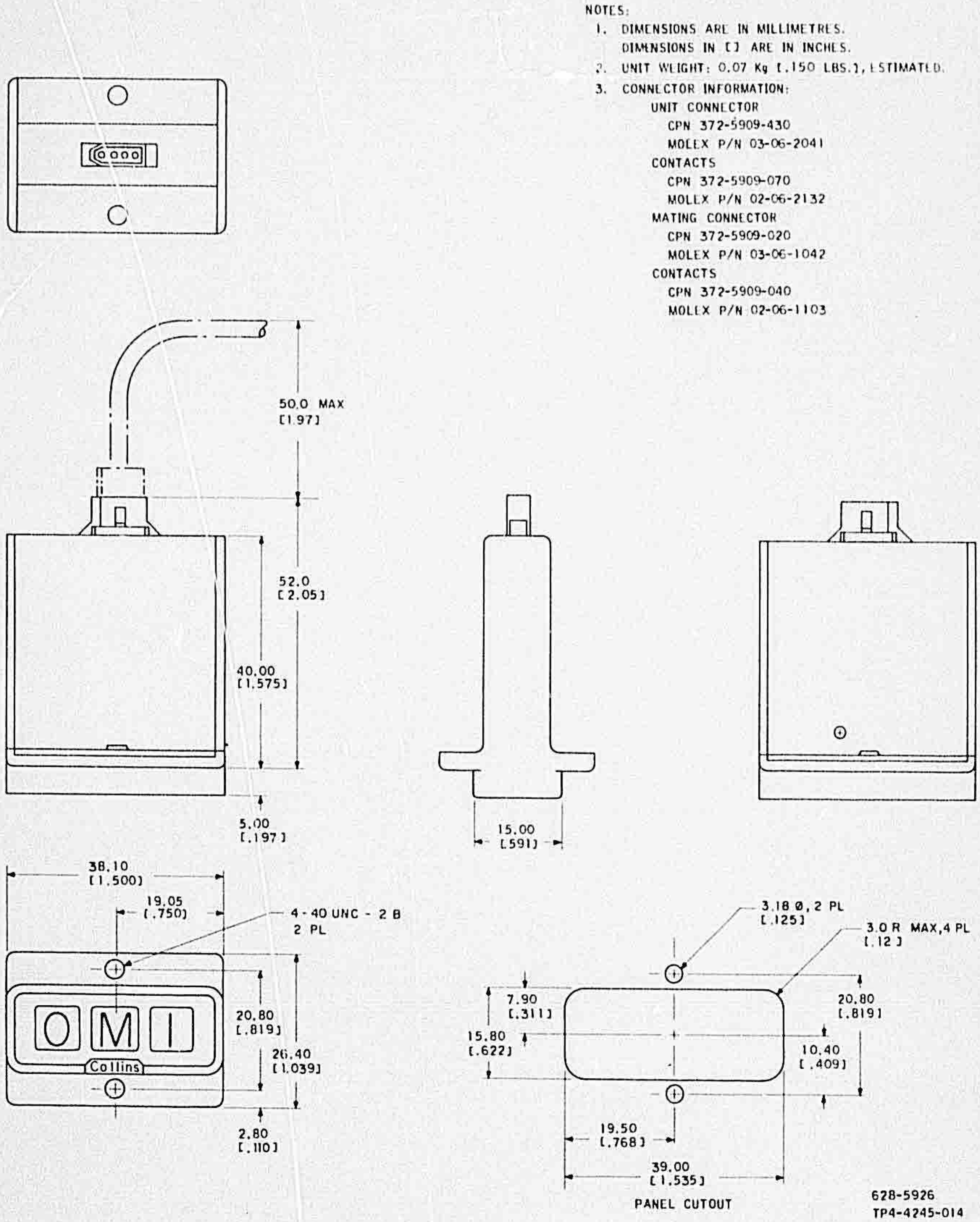
Figures 2-10 through 2-14 illustrate the interconnecting wiring diagrams for the MKR-350, MKL-350/351, AUD-250/250H, AUD-251H, and AMR-350/350H respectively. Mating connector part numbers are shown on the outline and mounting diagrams. Figures 2-15 through 2-19 are the mating connector pin assignments for the MKR-350, MKL-350/351, AUD-250/250H, AUD-251H, and AMR-350/350H.

During preparation of the interconnect wiring cables, observe the following precautions:

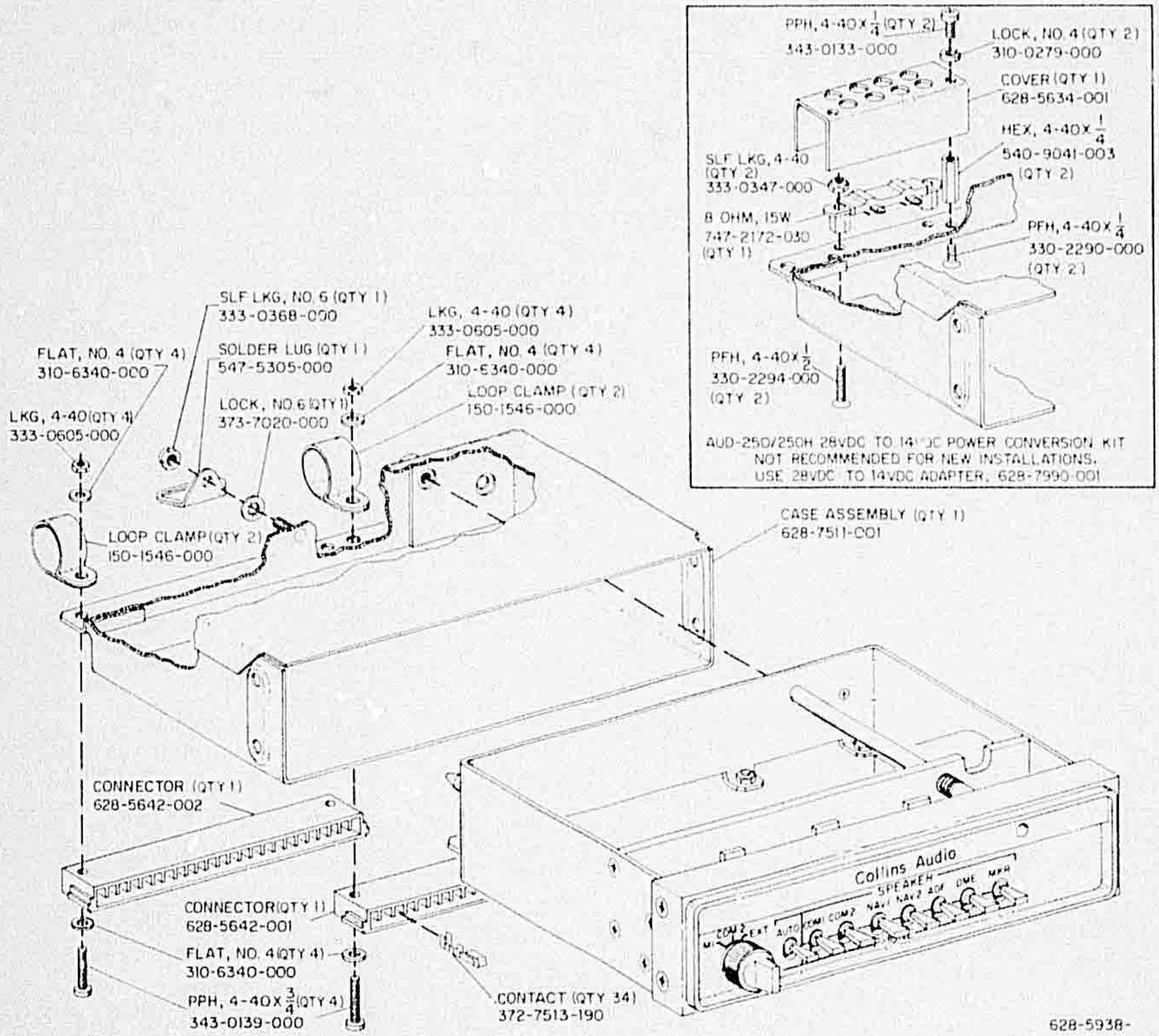
a. Bond and shield all parts of the aircraft electrical system, such as generator and ignition systems.
b. Keep the interconnect cables away from circuits carrying heavy current, pulse transmitting equipment, and other sources of interference.
c. Make all external connections of the equipment through the designated connectors listed on the interconnect wiring diagram.
d. Leave slack in cables to allow for movement due to vibration.
e. After installation of the cables in the aircraft and before installation of the equipment, check to ensure that aircraft power is applied only to the pins specified.
f. Remove and install connector contacts in accordance with steps g through i. Table 2-1 lists the special tools required to perform the following steps.
g. When preparing the mating connector, the connecting wire must be crimped in the contact so that the crimped portion of the contact can enter the connector shell.
h. Insert the contact into the proper connector shell hole and press until locked.
i. During removal of a contact, use the extraction tool to unlock the contact, and pull the contact out of the connector from the rear.

Table 2-1. Special Tools.

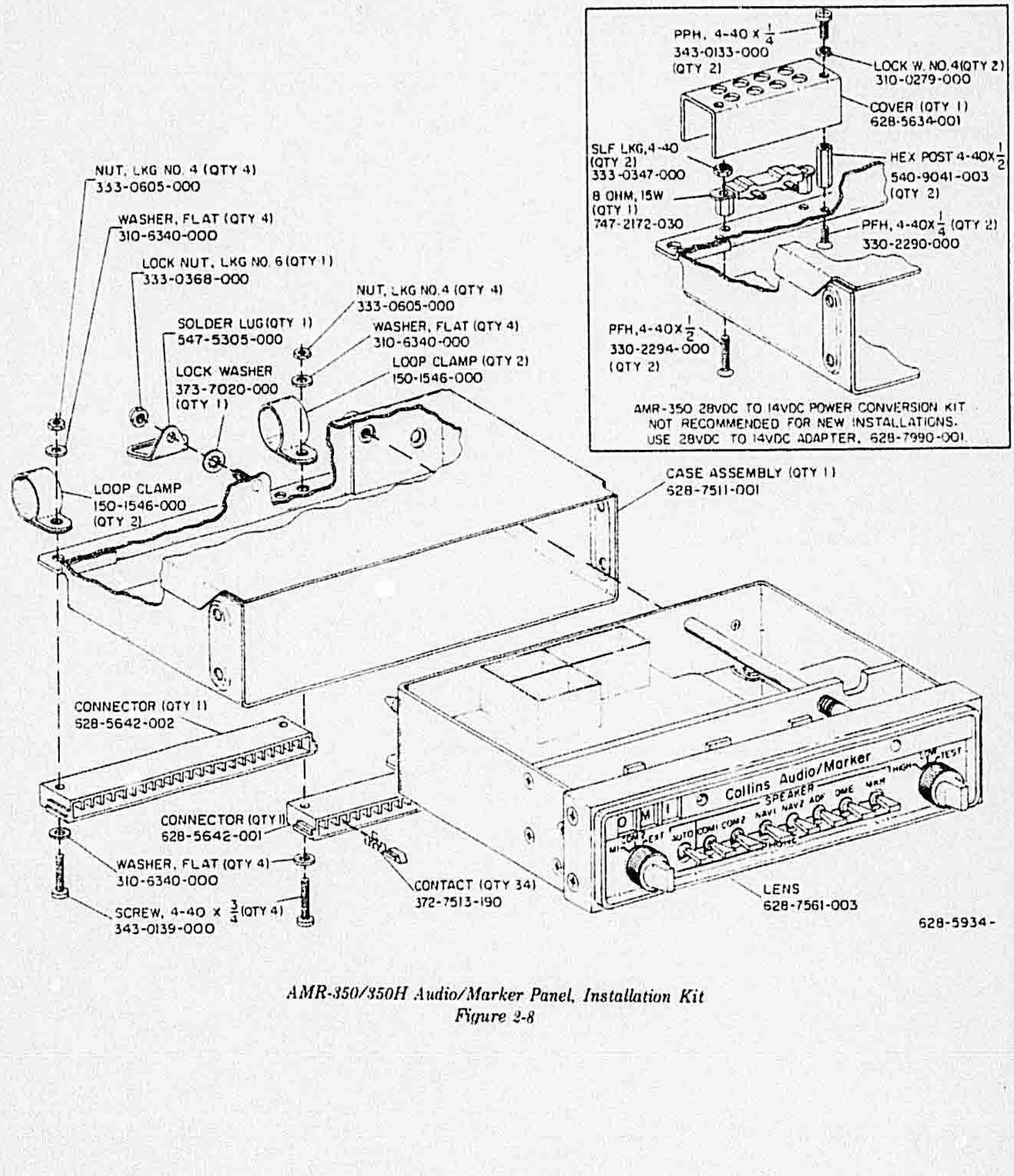
DESCRIPTION	MANUFACTURER AND TYPE	COLLINS PART NUMBER
MKR/MKL/AUD/AMR crimping tool (pliers)	Molex 11-01-0015	372-0065-020
MKR/MKL/AUD/AMR crimping tool (ratchet)	Molex 11-01-0008	372-0065-010
MKR/AUD/AMR extraction tool	Molex 11-03-0004	372-0065-030
MKL extraction tool	Molex 11-03-0009	372-0065-040



MKL-351 Remote Marker Lights, Outline and Mounting Dimensions
Figure 2-6



AUD-250/250H/251H Audio Panel, Installation Kit
Figure 2-7



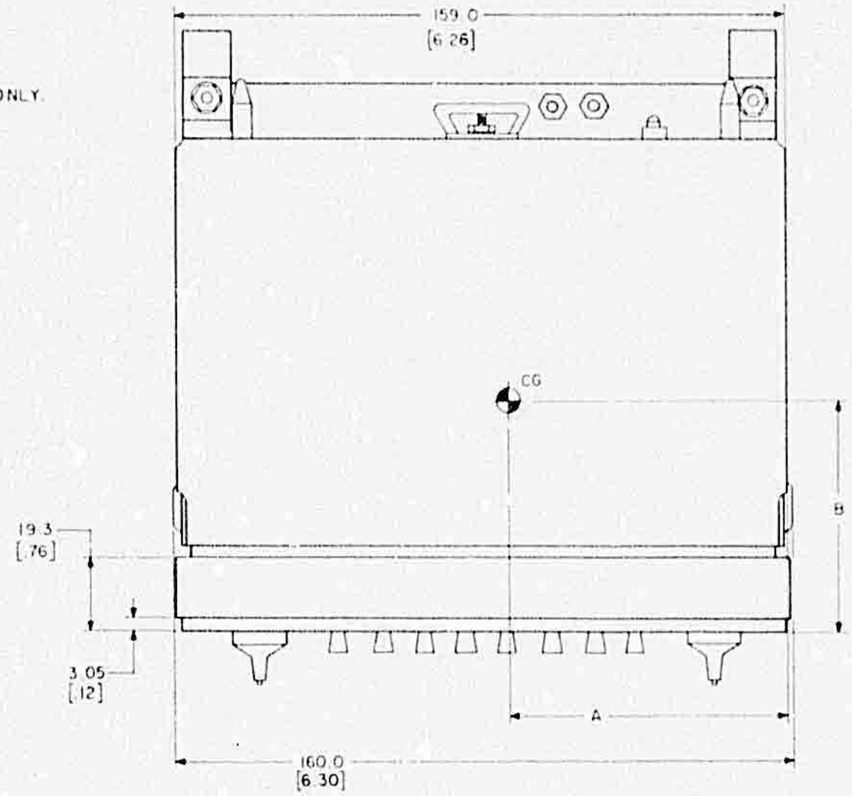
AMR-350/350H Audio/Marker Panel, Installation Kit
Figure 2-8

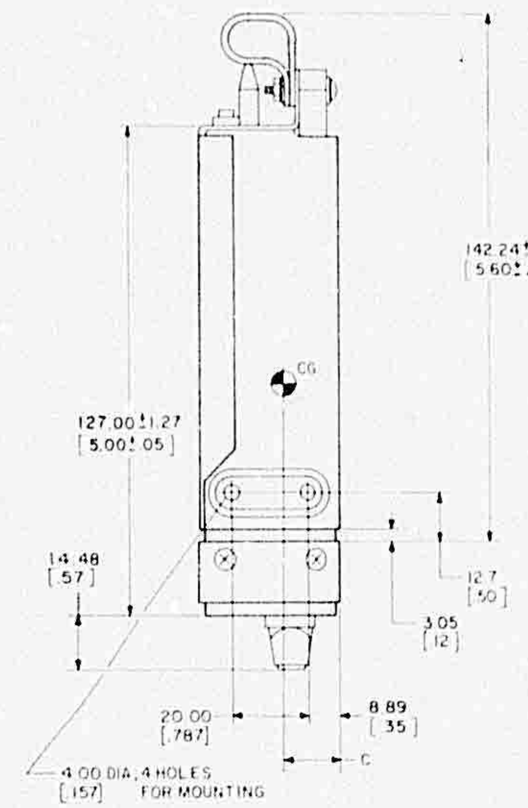
NOTES:
1. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm, [INCHES]
2. KNOB 'A' IS ON AMR-350, AMR-350H, AUD-251H, AND AUD-250H ONLY. LIGHTS 'B' ARE ON AMR-350 AND AMR-350H ONLY.
3. USE NO. 6 SCREWS FOR MOUNTING TRAY.

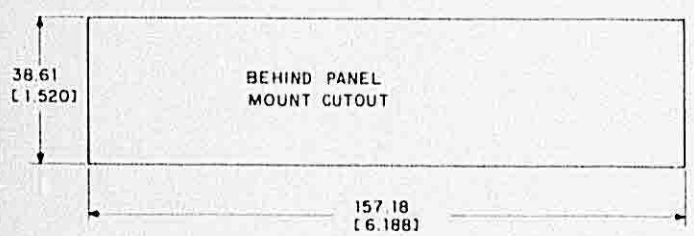
TYPE NO	WEIGHT kg	WEIGHT LBS
AUD-250	0.68	1.5
AUD-250H	0.68	1.5
AMR-350	0.82	1.8
AMR-350H	0.82	1.8
AUD-251H	0.68	1.5

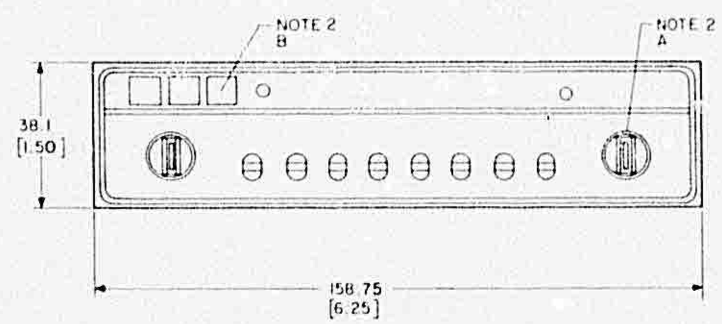
CG DIM CHART

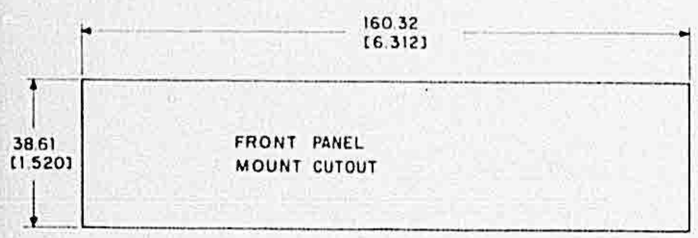
TYPE NO	A mm	A IN	B mm	B IN	C mm	C IN
AUD-250	71.0	2.80	61.2	2.41	15.2	.60
AUD-250H	71.0	2.80	61.2	2.41	15.2	.60
AMR-350	74.0	2.90	62.5	2.46	16.5	.65
AMR-350H	74.0	2.90	62.5	2.46	16.5	.65
AUD-251H	82.5	3.25	60.3	2.38	16.0	.63





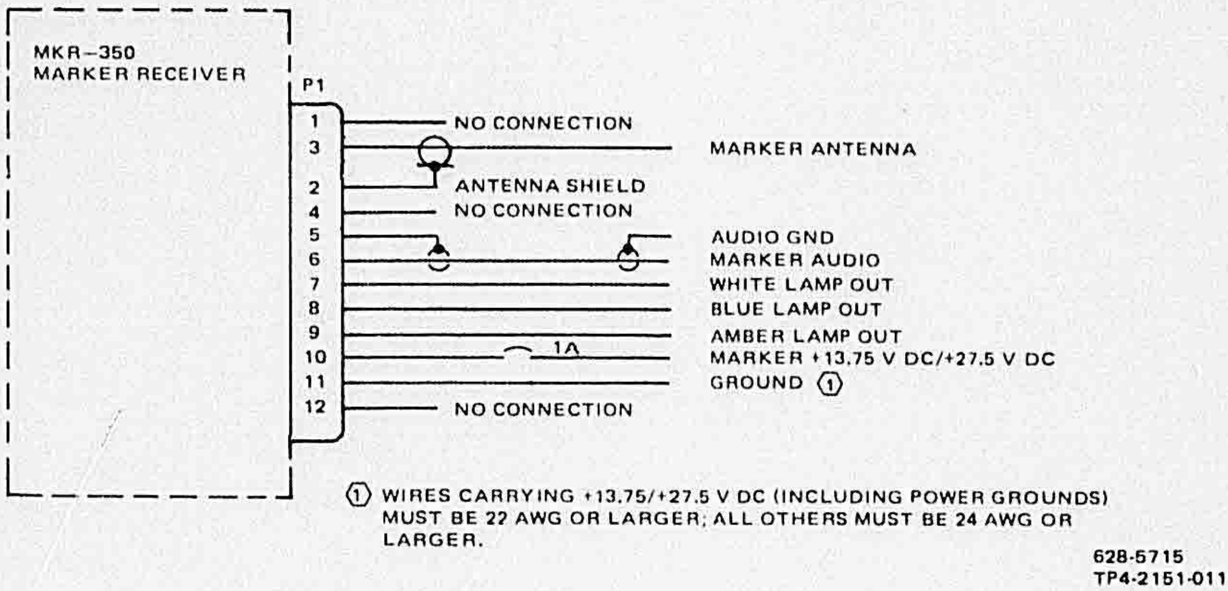




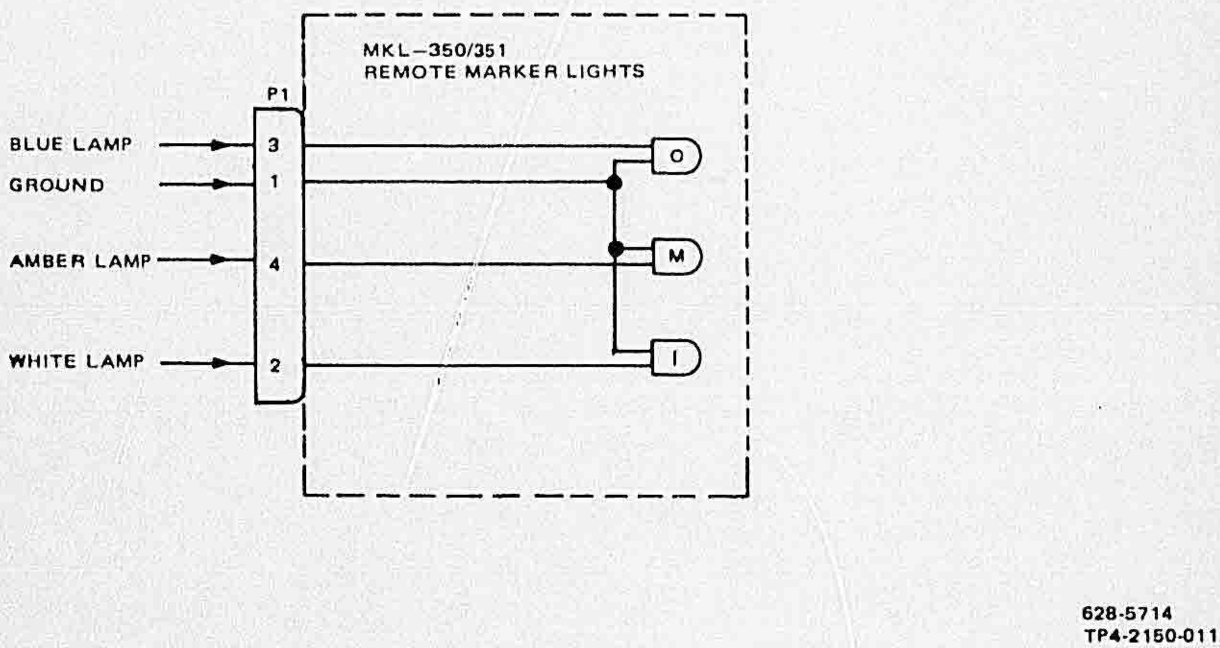


628-5703

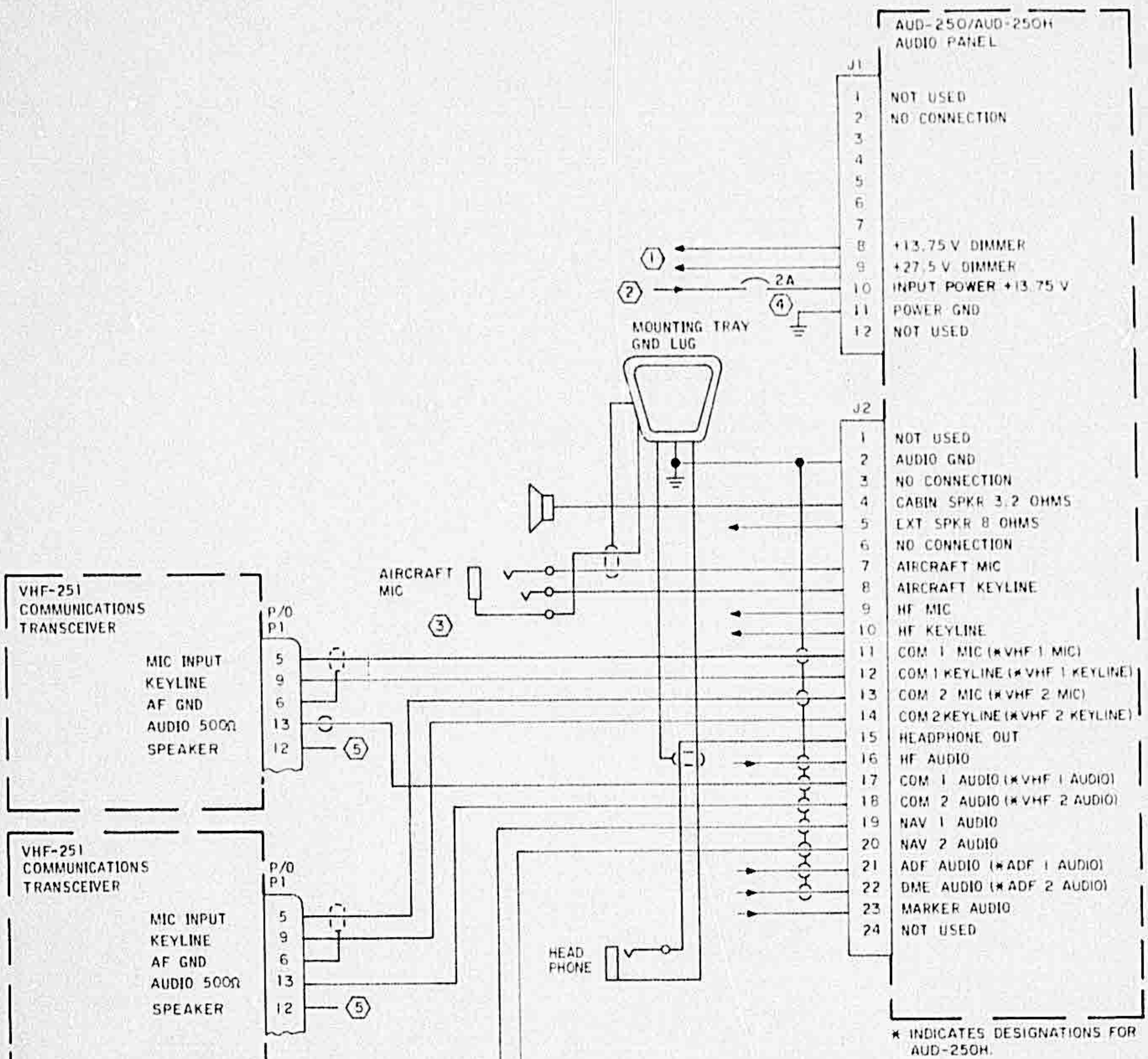
AUD-250/250H/251H and AMR-350/350H, Outline and Mounting Dimensions
Figure 2-9



MKR-350 Marker Receiver, Interconnecting Wiring Diagram
Figure 2-10



MKL-350/351 Remote Marker Lights, Interconnect Wiring Diagram
Figure 2-11



* INDICATES DESIGNATIONS FOR AUD-250H.

NOTES:

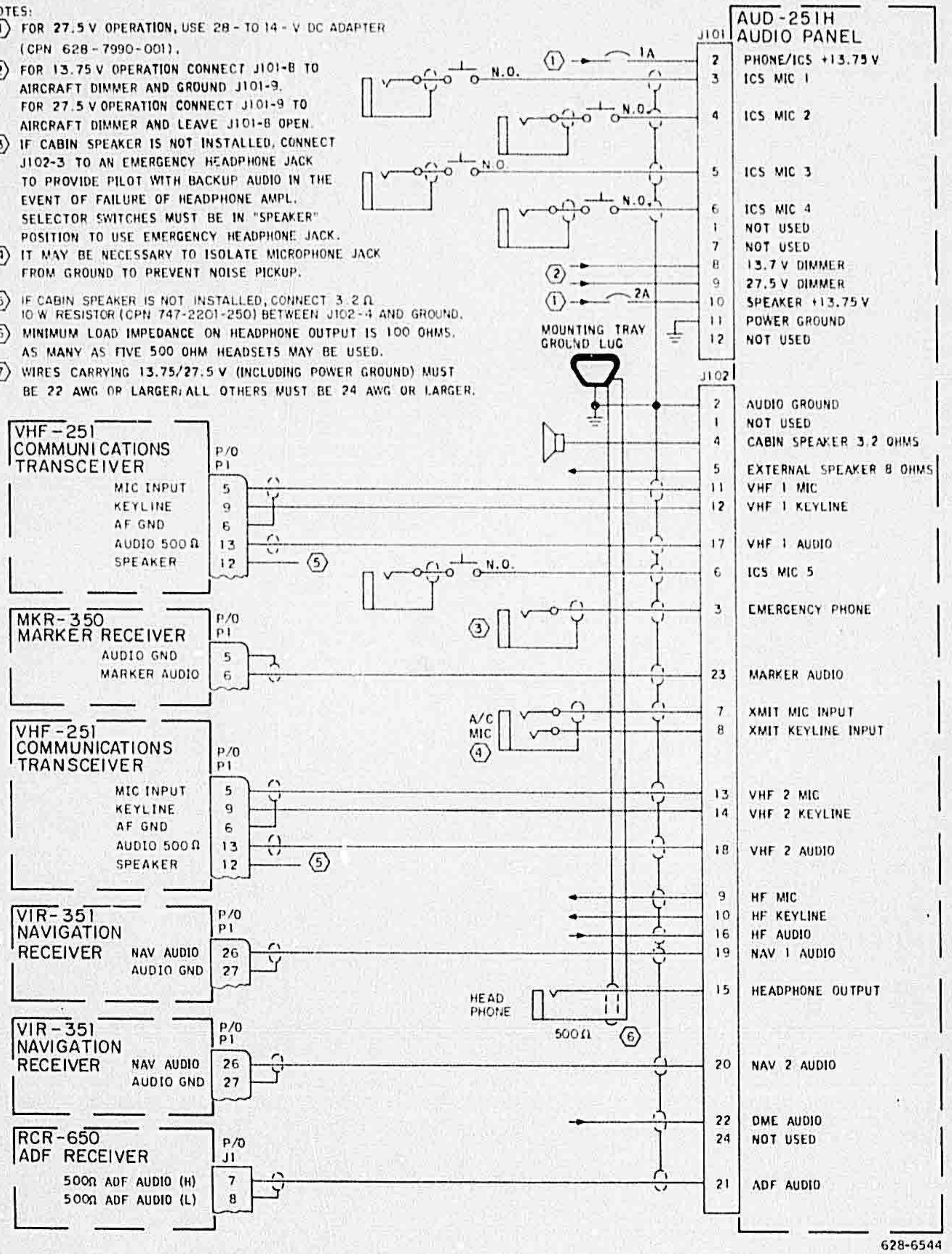
1. FOR +13.75 V OPERATION, GROUND PIN 9. FOR +27.5 V OPERATION, MAKE NO CONNECTION TO PIN 8.
2. FOR +27.5 V OPERATION, USE 28- TO 14-V DC ADAPTER (CPN 628-7990-001).
3. MAY BE NECESSARY TO ISOLATE MICROPHONE JACK FROM GROUND TO PREVENT NOISE PICKUP.
4. WIRES CARRYING +13.75/+27.5 V (INCLUDING POWER GROUNDS) MUST BE 22 AWG OR LARGER; ALL OTHERS MUST BE 24 AWG OR LARGER.
5. IF CABIN SPEAKER IS NOT INSTALLED, CONNECT 3.2 Ω, 10 W RESISTOR (CPN 747-2201-250) BETWEEN J2-4 AND GROUND.

628-5821
TP4-3067-014

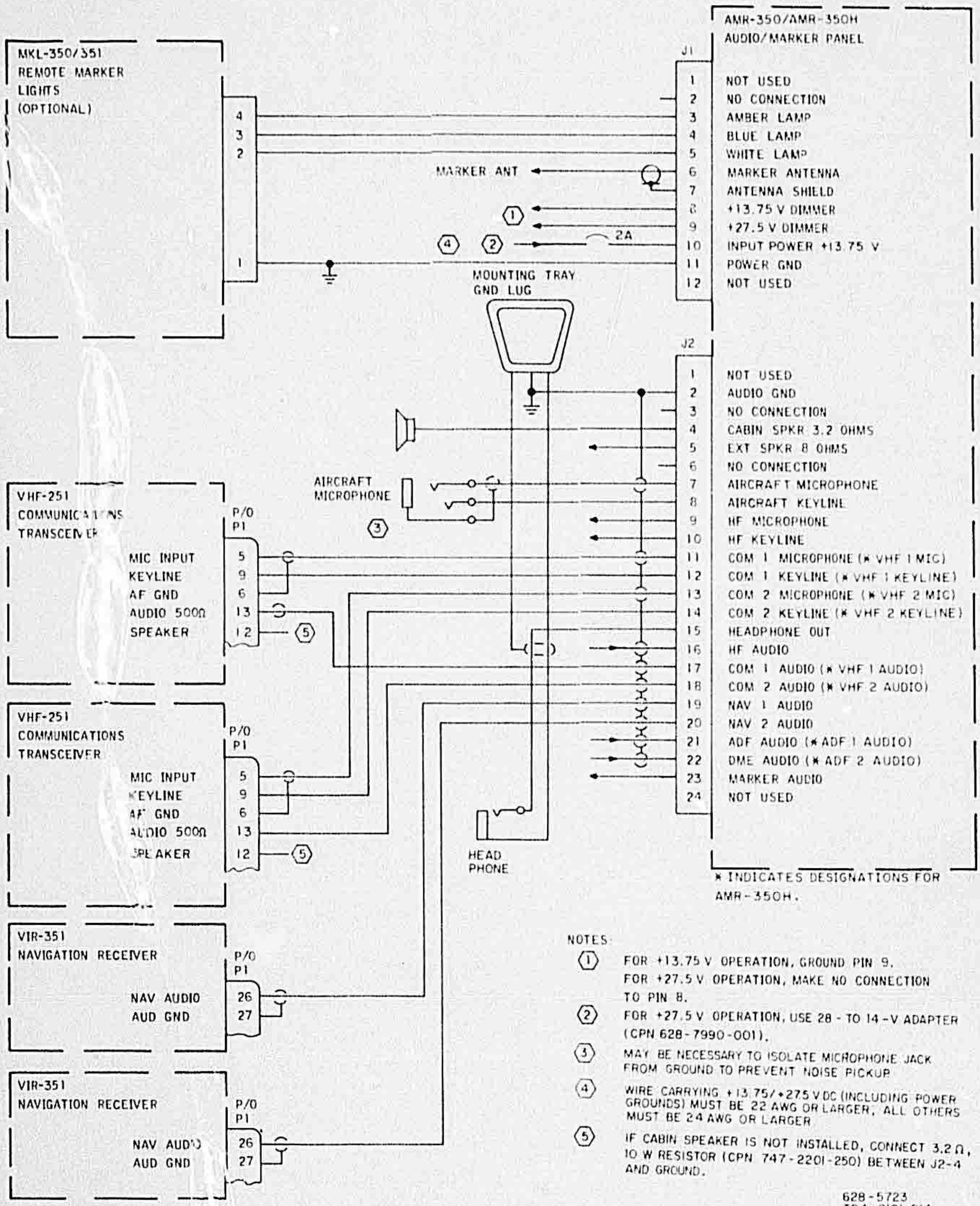
AUD-250/250H Audio Panel, Interconnect Wiring Diagram
Figure 2-12

NOTES:

1. FOR 27.5 V OPERATION, USE 28 - TO 14 - V DC ADAPTER (CPN 628-7990-001).
2. FOR 13.75 V OPERATION CONNECT J101-8 TO AIRCRAFT DIMMER AND GROUND J101-9. FOR 27.5 V OPERATION CONNECT J101-9 TO AIRCRAFT DIMMER AND LEAVE J101-8 OPEN.
3. IF CABIN SPEAKER IS NOT INSTALLED, CONNECT J102-3 TO AN EMERGENCY HEADPHONE JACK TO PROVIDE PILOT WITH BACKUP AUDIO IN THE EVENT OF FAILURE OF HEADPHONE AMPL. SELECTOR SWITCHES MUST BE IN "SPEAKER" POSITION TO USE EMERGENCY HEADPHONE JACK.
4. IT MAY BE NECESSARY TO ISOLATE MICROPHONE JACK FROM GROUND TO PREVENT NOISE PICKUP.
5. IF CABIN SPEAKER IS NOT INSTALLED, CONNECT 3.2 Ω 10 W RESISTOR (CPN 747-2201-250) BETWEEN J102-4 AND GROUND.
6. MINIMUM LOAD IMPEDANCE ON HEADPHONE OUTPUT IS 100 OHMS. AS MANY AS FIVE 500 OHM HEADSETS MAY BE USED.
7. WIRES CARRYING 13.75/27.5 V (INCLUDING POWER GROUND) MUST BE 22 AWG OR LARGER; ALL OTHERS MUST BE 24 AWG OR LARGER.



AUD-251H Audio Panel, Interconnect Wiring Diagram
Figure 2-13



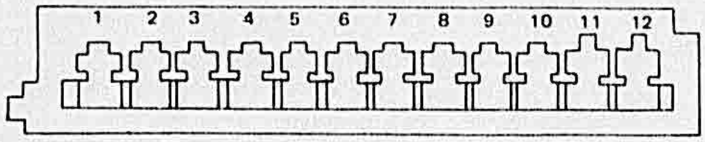
* INDICATES DESIGNATIONS FOR AMR-350H.

NOTES:

1. FOR +13.75 V OPERATION, GROUND PIN 9. FOR +27.5 V OPERATION, MAKE NO CONNECTION TO PIN 8.
2. FOR +27.5 V OPERATION, USE 28- TO 14-V ADAPTER (CPN 628-7990-001).
3. MAY BE NECESSARY TO ISOLATE MICROPHONE JACK FROM GROUND TO PREVENT NOISE PICKUP.
4. WIRE CARRYING +13.75/+27.5 VDC (INCLUDING POWER GROUNDS) MUST BE 22 AWG OR LARGER. ALL OTHERS MUST BE 24 AWG OR LARGER.
5. IF CABIN SPEAKER IS NOT INSTALLED, CONNECT 3.2 Ω, 10 W RESISTOR (CPN 747-2201-250) BETWEEN J2-4 AND GROUND.

628-5723
TP4-2181-014

AMR-350/350H Audio/Marker Panel, Interconnect Wiring Diagram
Figure 2-14



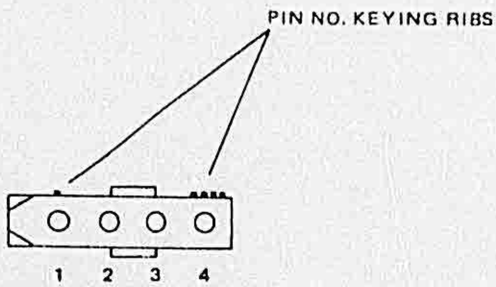
MKR-350 MATING CONNECTOR PIN ASSIGNMENTS

COLLINS PART NO. 628-7640-001
MOLEX PART NUMBER 09-01-1121

1. GROUND
2. ANTENNA SHIELD
3. MARKER ANTENNA
4. GROUND
5. GROUND
6. MARKER AUDIO
7. WHITE LAMP
8. BLUE LAMP
9. AMBER LAMP
10. MARKER +13.75 OR +27.5 V DC
11. GROUND
12. GROUND

628-5712
TP4-2147-012

MKR-350 Marker Receiver, Mating Connector Pin Assignments
Figure 2-15



MKL-350/351 MATING CONNECTOR PIN ASSIGNMENTS

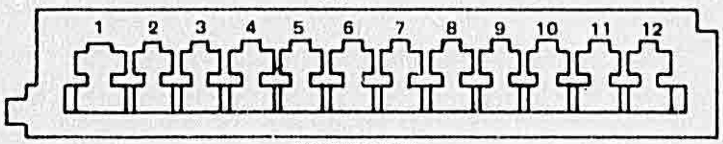
COLLINS PART NUMBER 372-5909-020
MOLEX PART NUMBER 03-06-1042

1. GROUND
2. WHITE LAMP
3. BLUE LAMP
4. AMBER LAMP

628-5713
TP4-2148-011

MKL-350/351 Remote Marker Lights, Mating Connector Pin Assignments
Figure 2-16

J1



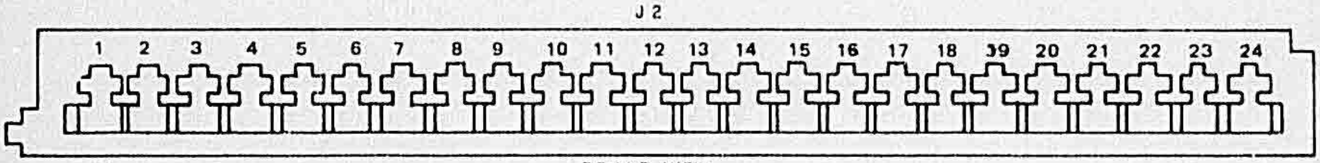
FRONT VIEW

COLLINS PART NUMBER 628-5642-001
MOLEX PART NUMBER 09-01-1121 (MODIFIED)

1. NOT USED
2. NO CONNECTION
3. NO CONNECTION
4. NO CONNECTION
5. NO CONNECTION
6. NO CONNECTION
7. NO CONNECTION
8. +13.75 V DIMMER
9. +27.5 V DIMMER
10. (1) INPUT POWER +13.75 V
11. POWER GROUND
12. NOT USED

(1) FOR +27.5 V OPERATION 28 TO 14 VOLT POWER CONVERSION KIT, COLLINS PART NUMBER 628-5633-001, MUST BE USED.

J2



FRONT VIEW

COLLINS PART NUMBER 628-5642-002
MOLEX PART NUMBER 09-01-2241 (MODIFIED)

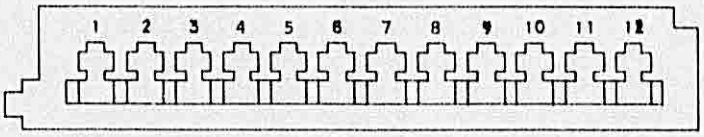
1. NOT USED
2. AUDIO GROUND
3. NO CONNECTION
4. CABIN SPEAKER 3.2 OHMS
5. EXT SPEAKER 8 OHMS
6. NO CONNECTION
7. AIRCRAFT MICROPHONE
8. AIRCRAFT KEYLINE
9. HF MICROPHONE
10. HF KEYLINE
11. COM 1 MICROPHONE (*VHF 1 MIC)
12. COM 1 KEYLINE (*VHF 1 KEYLINE)
13. COM 2 MICROPHONE (*VHF 1 MIC)
14. COM 2 KEYLINE (*VHF 2 KEYLINE)
15. HEADPHONE OUT
16. HF AUDIO
17. COM 1 AUDIO (*VHF 1 AUDIO)
18. COM 2 AUDIO (*VHF 2 AUDIO)
19. NAV 1 AUDIO
20. NAV 2 AUDIO
21. ADF AUDIO (*ADF 1 AUDIO)
22. DME AUDIO (ADF 2 AUDIO)
23. MARKER AUDIO
24. NOT USED

* INDICATES DESIGNATIONS FOR AUD–250H

628-5722
TP4-2170-011

AUD-250/250H Audio Panel, Mating Connector Pin Assignments
Figure 2-17

J101

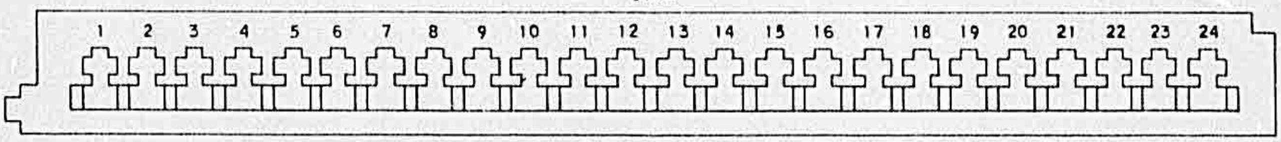


FRONT VIEW

COLLINS PART NUMBER 628-5642-001
MOLEX PART NUMBER 09-01-1121 (MODIFIED)

1. NOT USED
2. PHONE/ICS +13.75 V
3. ICS MIC 1
4. ICS MIC 2
5. ICS MIC 3
6. ICS MIC 4
7. NOT USED
8. +13.75 V DIMMER
9. +27.5 V DIMMER
10. SPEAKER +13.75 V
11. POWER GROUND
12. NOT USED

J102



FRONT VIEW

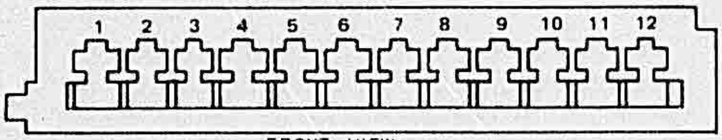
COLLINS PART NUMBER 628-5642-002
MOLEX PART NUMBER 09-01-2241 (MODIFIED)

1. NOT USED
2. AUDIO GROUND
3. EMERGENCY PHONE
4. CABIN SPEAKER 3.2 OHMS
5. EXT SPEAKER 8 OHMS
6. ICS MIC 5
7. XMIT MIC INPUT
8. XMIT KEYLINE INPUT
9. HF MICROPHONE
10. HF KEYLINE
11. VHF 1 MICROPHONE
12. VHF 1 KEYLINE
13. VHF 2 MICROPHONE
14. VHF 2 KEYLINE
15. HEADPHONE OUT
16. HF AUDIO
17. VHF 1 AUDIO
18. VHF 2 AUDIO
19. NAV 1 AUDIO
20. NAV 2 AUDIO
21. ADF AUDIO
22. DME AUDIO
23. MARKER AUDIO
24. NOT USED

628-6542

AUD-251H Audio Panel, Mating Connector Pin Assignments
Figure 2-18

J1



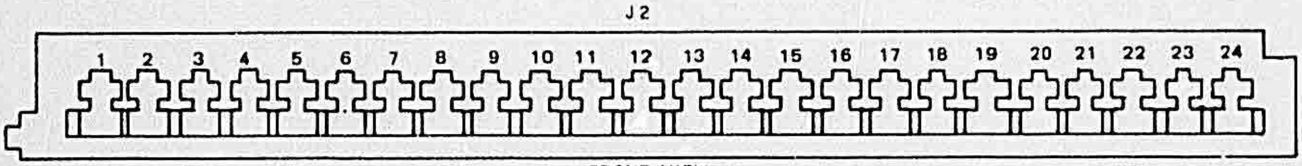
FRONT VIEW

COLLINS PART NUMBER 628-5642-001
MOLEX PART NUMBER 09-01-1121 (MODIFIED)

1. NOT USED
2. NO CONNECTION
3. AMBER LAMP
4. BLUE LAMP
5. WHITE LAMP
6. MARKER ANTENNA
7. ANTENNA SHIELD
8. +13.75 V DIMMER
9. +27.5 V DIMMER
10. INPUT POWER + 13.75 V (1)
11. POWER GROUND
12. NOT USED

(1) FOR +27.5 V OPERATION, 28 TO 14 VOLT POWER CONVERSION KIT, COLLINS PART NUMBER 628-5633-001, MUST BE USED.

J2



FRONT VIEW

COLLINS PART NUMBER 628-5642-002
MOLEX PART NUMBER 09-01-2241 (MODIFIED)

1. NOT USED
2. AUDIO GROUND
3. NO CONNECTION
4. CABIN SPEAKER 3.2 OHMS
5. EXT SPEAKER 8 OHMS
6. NO CONNECTION
7. AIRCRAFT MICROPHONE
8. AIRCRAFT KEYLINE
9. HF MICROPHONE
10. HF KEYLINE
11. COM 1 MICROPHONE (*VHF 1 MIC)
12. COM 1 KEYLINE (*VHF 1 KEYLINE)
13. COM 2 MICROPHONE (*VHF 2 MIC)
14. COM 2 KEYLINE (*VHF 2 KEYLINE)
15. HEADPHONE OUT
16. HF AUDIO
17. COM 1 AUDIO (*VHF 1 AUDIO)
18. COM 2 AUDIO (*VHF 2 AUDIO)
19. NAV 1 AUDIO
20. NAV 2 AUDIO
21. ADF AUDIO (*ADF 1 AUDIO)
22. DME AUDIO (*ADF 2 AUDIO)
23. MARKER AUDIO OUTPUT
24. NOT USED

*INDICATES DESIGNATIONS FOR AMR–350H

628-5721
TP4-2169-031

AMR-350/350H Audio/Marker Panel, Mating Connector Pin Assignments
Figure 2-19

2.6 POSTINSTALLATION CHECKS

After all cabling has been installed and the equipment has been mounted in the aircraft, make the operational checks outlined below to ensure correct operation of the equipment in the aircraft. These tests must be made using the aircraft power with the engines operating.

2.6.1 *MKR-350 and MKL-350/351*

a. Select the TEST position on the front of the MKR-350 by depressing and holding the HIGH/LOW/TEST switch. Lights should now be on at maximum intensity.
b. The MKL-350/351 Remote Marker Lights are tested by switching to the marker receiver TEST position. Lights should come on at maximum intensity.
c. Raise the whip antenna on the ramp test set and set it directly beneath the marker beacon antenna. Set the ramp tester for a 10,000-μV output with 90-percent modulation at 3000 Hz. Set the MKR-350 HIGH/LOW/TEST select control to the HIGH position. A 3000-Hz tone should be clearly audible in the aircraft audio system, and the white marker lamp should be brightly lighted.
d. Change the modulating frequency of the ramp test set to 1300 Hz. A 1300-Hz tone should be audible in the aircraft audio system, and the amber marker lamp should be brightly lighted.
e. Change the modulating frequency of the ramp test set to 400 Hz. A 400-Hz tone should be clearly audible in the aircraft audio system, and the blue marker light should be brightly lighted. Repeat steps c, d, and e with the HIGH/LOW/TEST select control in the LOW position.
f. The audio level of the three marker tones may be adjusted to the proper volume using internal audio control resistor R45. This control is preset and ordinarily requires no adjustment.

Caution

Do not adjust AGC and sensitivity controls R12, R13, or R26. Proper adjustment of these controls must be made under bench test conditions.

2.6.2 *AUD-250 Audio Panel*

a. Position all audio control switches to their center (off) position. Set COM 1/COM 2/EXT control (microphone selector switch) to COM 1.
b. Apply power to the communications transceivers, navigation receivers, adf, DME, and marker beacon receiver.
c. Channel communication transceivers to the operating frequency of a known station in the immediate area.
d. Position the AUTO control switch to the SPEAKER position. Audio received by communication transceiver 1 should now be present in cabin speaker. Position the AUTO control switch to PHONE. Audio received by communications transceiver 1 should be present in the headset.
e. Press the microphone push-to-talk (ptt) switch and obtain a signal check for transceiver 1.
f. Turn the COM 1/COM 2/EXT control to COM 2. Audio from transceiver 2 should be present in headset. Switch the AUTO control switch to SPEAKER, and observe audio from transceiver 2 in cabin speaker.
g. Press microphone ptt switch and obtain a signal check for transceiver 2.
h. Position COM 1/COM 2/EXT control to EXT. If ramp hailer or passenger address system has been wired, audio directed at the microphone with the ptt switch depressed will be present in these systems. If necessary, adjust audio level control R219.
i. Set AUTO control switch to its center (off) position.
j. Set the COM 1 control switch to the SPEAKER position. Audio from transceiver 1 should be present. Switch COM 1 control to PHONE. Audio from transceiver 1 should be present.
k. Set COM 1 control switch to its center position. Position COM 2 control switch to SPEAKER, then PHONE, and check for audio in both positions. Position COM 2 control switch to its middle position.
l. Channel both navigation receivers to the operating frequency of a station in the immediate area. Check for audio in both SPEAKER and PHONE positions for each of the two receivers. Positon NAV 1 and NAV 2 control switches to their center positions.
m. Select a station on the adf receiver. Toggle the ADF control to the SPEAKER and PHONE positions. Observe audio in both positions. Repositon the ADF control to its center position.
n. Channel a navigation receiver to a colocated VOR/DME station. Position the DME control switch to SPEAKER, then PHONE, and check for reception of the DME identification code in each position.

2.6.3 AUD-250H Audio Panel

a. Position all audio control switches to center (off) position. Set HF/VHF 1/VHF 2/EXT control (microphone selector switch) to HF.

b. Apply power to the communications transceivers, navigation receivers, automatic direction finders, and marker beacon receiver.

c. Channel the communications transceivers to the operating frequency of a known station in the immediate area.

d. Position the AUTO control to the SPKR position. Audio received by the hf transceiver should be present in the cabin speaker. Position the control to PHONE. Audio received by the hf transceiver should be present in the headset.

e. Press the microphone push-to-talk (ptt) switch and obtain a signal check for the hf.

f. Switch the HF/VHF 1/VHF 2/EXT control to VHF 1. Audio from vhf transceiver 1 should be present in the headset. Switch the AUTO control to SPKR, and observe audio from VHF 1 in cabin speaker.

g. Press microphone ptt switch and obtain a signal check for VHF 1.

h. Switch the HF/VHF 1/VHF 2/EXT control to VHF 2. Audio from VHF 2 should be present in cabin speaker. Switch the AUTO control to PHONE, and observe audio from VHF 2 in headset.

i. Press microphone ptt switch and obtain a signal check for VHF 2.

j. Position the HF/VHF 1/VHF 2/EXT control to EXT. If ramp hailer or passenger address system has been wired, audio directed at the microphone with the microphone ptt switch depressed will be present in these systems. If necessary, adjust audio level control R219.

k. Set the AUTO control to OFF.

l. Set the HF control switch to the SPEAKER position. Audio from the hf transceiver should be present in cabin speaker. Switch HF control to PHONE. Audio from the hf should be present in the headset. Return the HF control switch to its center (off) position.

m. Repeat the switching procedure of step l for VHF 1, VHF 2, NAV 1, NAV 2, ADF 1, ADF 2, and MKR controls.

2.6.4 AUD-251H Audio Panel

a. Position all audio control switches to their center (off) position. Set VHF 1/VHF 2/HF/EXT control (microphone selector switch) to VHF 1.

b. With engines running at a normal in-flight noise level, adjust ICS level control potentiometer R324 for a comfortable level with one crew member speaking into microphone. If L-pad volume controls are installed on headsets the midrange position should be selected prior to adjustment.

c. Apply power to the communications transceivers, navigation receivers, automatic direction finder, DME, and marker beacon receiver.

d. Channel the communications transceivers to the operating frequency of a known station in the immediate area.

e. Position the AUTO control to the SPKR position. Audio received by the transceiver should be present in the cabin speaker. Position the AUTO control to PHONE. Audio received by the VHF 1 transceiver should be present in the headset.

f. Press the microphone push-to-talk (ptt) switch and obtain a signal check for VHF 1. Observe side tone level and adjust as necessary to provide a comfortable level (adjustment is made within VHF 1).

g. Switch the VHF 1/VHF 2/HF/EXT control to VHF 2. Audio from vhf transceiver 2 should be present in the headset. Switch the AUTO control to SPKR, and observe audio from VHF 2 in cabin speaker.

h. Press microphone ptt switch and obtain a signal check for VHF 2; adjust sidetone as required.

i. Switch the VHF 1/VHF 2/HF/EXT control to HF. Audio from the HF should be present in cabin speaker. Switch the AUTO control to PHONE, and observe audio from the hf transceiver in the headset.

j. Press microphone ptt switch and obtain a signal check for the hf transceiver; adjust sidetone as required.

k. Position the VHF 1/VHF 2/HF/EXT control to EXT. If a ramp hailer or passenger address system has been wired, audio directed at the microphone with the microphone ptt switch depressed will be present in these systems. If necessary, adjust external audio level control R219.

l. Set the AUTO control to OFF.

m. Set the HF control to the SPEAKER position. Audio from the hf transceiver should be present in the cabin speaker. Switch the HF control to PHONE. Audio from the hf should be present in the headset. Return the HF control switch to its center (off) position.

n. Repeat the switching procedure of step 1 for VHF 1, VHF 2, NAV 1, NAV 2, ADF, DME, and MKR controls. When checking marker receiver operation, adjust audio level (within marker receiver) to a comfortable level.

o. Check for presence of intercom audio in each headset when each intercom microphone is keyed.

2.6.5 AMR-350 Audio/Marker Panel

a. Select the marker lamp TEST position by turning and holding the MARKER HIGH/LOW/TEST control in the TEST position. Marker lights should now be on at maximum intensity. Remote marker lights, when connected, should also be at maximum intensity.

b. Raise the whip antenna on the ramp test set and set it directly beneath the marker beacon antenna. Set the ramp tester for a 10,000-μV output with 90-percent modulation at 3000 Hz. Set the AMR-350 MARKER HIGH/LOW/TEST select control to the HIGH position. A 3000-Hz tone should be clearly audible in the aircraft audio system, and the white marker lamp should be brightly lighted.

c. Change the modulating frequency of the ramp test set to 1300 Hz. A 1300-Hz tone should be audible in the aircraft audio system, and the amber marker lamp should be brightly lighted.

d. Change the modulating frequency of the ramp test set to 400 Hz. A 400-Hz tone should be clearly audible in the aircraft audio system, and the blue marker lamp should be brightly lighted. Repeat steps b, c, and d with the MARKER HIGH/LOW/TEST select control set to the LOW position.

e. The audio level of the three marker tones may be adjusted to the proper volume using internal audio control resistor R45. This control is preset and ordinarily should not require adjustment.

Caution

Do not adjust AGC and sensitivity controls R12, R13, or R26. Proper adjustment of these controls must be made under bench-test conditions.

f. Position all audio control switches to their center (off) position. Set COM 1/COM 2/EXT control (microphone selector switch) to COM 1.

g. Apply power to the communications transceivers, navigation receivers, adf, and DME.

h. Channel communication transceivers to the operating frequency of a known station in the immediate area.

i. Position the AUTO control switch to the SPEAKER position. Audio received by communication transceiver 1 should now be present in cabin speaker. Position the AUTO control switch to PHONE. Audio received by communications transceiver 1 should be present in the headset.

j. Press the microphone push-to-talk (ptt) switch and obtain a signal check for transceiver 1.

k. Turn the COM 1/COM 2/EXT control to COM 2. Audio from transceiver 2 should be present in headset. Switch the AUTO control switch to SPEAKER, and observe audio from transceiver 2 in cabin speaker.

l. Press microphone ptt switch and obtain a signal check for transceiver 2.

m. Position COM 1/COM 2/EXT control to EXT. If ramp hailer or passenger address speaker has been wired, audio directed at the microphone with the ptt switch depressed will be present in the speaker. If necessary, adjust audio level control R219.

n. Set AUTO control switch to its center (off) position. Set COM 1/COM 2/EXT control to COM 1.

o. Set the COM 1 control switch to the SPEAKER position. Audio from transceiver 1 should be present. Switch COM 1 control to PHONE. Audio from transceiver 1 should be present.

p. Set COM 1 control switch to its center position. Using the COM 1/COM 2/EXT control, select COM 2. Position COM 2 control switch to SPEAKER, then PHONE, and check for audio in both positions. Position COM 2 control switch to its middle position.

q. Channel both navigation receivers to the operating frequency of a station in the immediate area. Check for audio in both SPEAKER and PHONE positions for each of the two receivers. Position NAV 1 and NAV 2 control switches to their center positions.

r. Select a station on the adf receiver. Toggle the ADF control to the SPEAKER and PHONE positions. Observe audio in both positions. Reposition the ADF control to its center positon.

s. Channel a navigation receiver to a colocated VOR/DME station. Position the DME control switch to SPEAKER, then PHONE, and check for reception of the DME identification code in each position.

2.6.6 AMR-350H Audio/Marker Panel

a. Select the marker lamp TEST position by turning and holding the MARKER HIGH/LOW/TEST control in the TEST position. Marker lights should now be on at maximum intensity. Remote marker lights, when connected, should also be at maximum intensity.

b. Raise the whip antenna on the ramp test set and set it directly beneath the marker beacon antenna. Set the ramp tester for a 10,000-μV output with 90-percent modulation at 3000 Hz. Set the AMR-350H MARKER HIGH/LOW/TEST select control to the HIGH position. A 3000-Hz tone should be clearly audible in the aircraft audio system, and the white marker lamp should be brightly lighted.

c. Change the modulating frequency of the ramp test set to 1300 Hz. A 1300-Hz tone should be audible in the aircraft audio system, and the amber marker lamp should be brightly lighted.

d. Change the modulating frequency of the ramp test set to 400 Hz. A 400-Hz tone should be clearly audible in the aircraft audio system, and the blue marker lamp should be brightly lighted. Repeat steps b, c, and d with the MARKER HIGH/LOW/TEST select control set to the LOW position.

e. The audio level of the three marker tones may be adjusted to the proper volume using internal audio control resistor R45. This control is preset and ordinarily should not require adjustment.

Caution

Do not adjust AGC and sensitivity controls R12, R13, or R26. Proper adjustment of these controls must be made under bench test conditions.

f. Position all audio control switches to their center (off) position. Set HF/VHF 1/VHF 2/EXT control (microphone selector switch) to HF.

g. Apply power to the communications transceivers, navigation receivers, and automatic direction finders.

h. Channel transceivers to the operating frequency of a known station in the immediate area.

i. Switch the HF switch (toggle) to SPEAKER and observe received signal is present in cabin speaker. Switch the HF control switch to PHONE. Audio from the hf transceiver should not be present in the headset.

j. Press the microphone push-to-talk (ptt) switch and obtain a signal check for the hf transceiver. Return the HF switch to the center position.

k. Switch the HF/VHF 1/VHF 2/EXT control to VHF 1. Ensure audio is present in both the SPEAKER and PHONE positions. Obtain a signal check for VHF 1.

l. Switch the HF/VHF 1/VHF 2/EXT control to VHF 2. Ensure audio is present in both the SPEAKER and PHONE positions. Obtain a signal check for VHF 2.

m. Switch the HF/VHF 1/VHF 2/EXT control to EXT. If ramp hailer or passenger address speaker has been wired, audio directed at the microphone with the ptt switch depressed will be present in the speaker. If necessary, adjust audio level control R219.

n. Perform audio checks for NAV 1, NAV 2, ADF 1, ADF 2, and MKR control switches to ensure audio is present in both SPEAKER and PHONE positions.

Collins MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

Rockwell International

operation

Collins General Aviation Division

Printed in USA

523-0766038-005118
5th Edition, 9 June 1982

table of contents

NOTICE: This section replaces fourth edition dated 1 June 1978.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL,
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None
2nd Ed	1 Sep 75		AMR-350/350H AUD-250/250H; SIL 1-75, 2-75; AMR-350H: SB 1
3rd Ed	15 Jun 76		Same as above
4th Ed	1 Jun 78		MKR-350: SB 1, 2, SIL 1-77, 2-77; AUD-250: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77, 2-77; AUD-250H: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77, 2-77; AUD-251H: SB 1, SIL 1-76; AMR-350: SB 1, 2, 3, SIL 1-75, 2-75, 1-76, 1-77 thru 4-77; AMR-350H: SB 1, 2, 3, 4, SIL 1-75, 2-75, 1-76, 1-77 thru 4-77
5th Ed	9 Jun 82		Those above plus: MKR-350: SB 3, 4, SIL 1-79; AUD-250: SIL 1-79; AUD-250H: SB 3R1, 4, SIL 1-79; AUD-251H: SB 2, 3R1, 4, SIL 1-78; AMR-350: SB 2R1, 4, 5R1, 6, SIL 1-79, 2-79, 3-79; AMR-350H: SB 5, 6, 7, 8, SIL 1-79, 2-79, 3-79

section III

operation

3.1 GENERAL

The purpose of this section is to provide a description of the displays and control functions provided by the equipment.

3.2 DISPLAYS AND CONTROLS

3.2.1 MKR-350 Marker Receiver (Refer to figure 3-1.)

3.2.1.1 HIGH/LOW/TEST Select

The HIGH/LOW/TEST selector allows the pilot to control receiver sensitivity and perform a lamp test on the MKR-350 and MKL-350. When in the HIGH position, receiver sensitivity is increased to a 200-μV level. Operation in this mode is normally used for enroute flight. An aircraft flying at a high altitude or slightly off course may fail to receive the marker signal in the LOW position. The HIGH/LOW/TEST select switch may be placed in the HIGH position until the signal is received. At this time, switching to LOW will decrease the duration of reception which, in turn, produces a more accurate measure of passage. Operation in the LOW position is typically used when making an approach. Flight in the HIGH sensitivity position therefore gives the pilot an advance indication upon approaching the outer marker. With the MKR-350 in the HIGH position, aural reception will begin about 1.6 kilometers (1 mile) from the center of the outer marker.

The selection of TEST places the marker lights at full intensity. Remote marker lights, when used, will also be tested upon selection of the TEST position.

3.2.1.2 Outer, Middle, and Inner Marker Lights

The marker lights provide the pilot with a visual indication of marker beacon passage.

3.2.1.3 Ambient Light Sensor

A photocell monitoring the cockpit ambient light level automatically adjusts the marker display brightness to an optimum level.

3.2.2 MKL-350/351 Remote Marker Lights (Refer to figure 3-2.)

3.2.2.1 Outer, Middle, and Inner Marker Lights

The marker lights provide the pilot with a visual indication of marker beacon passage. Since MKL-350 and MKL-351 presentations are identical, only the MKL-351 is illustrated.

3.2.3 AUD-250 Audio Panel (Refer to figure 3-3.)

3.2.3.1 COM 1/COM 2/EXT Control

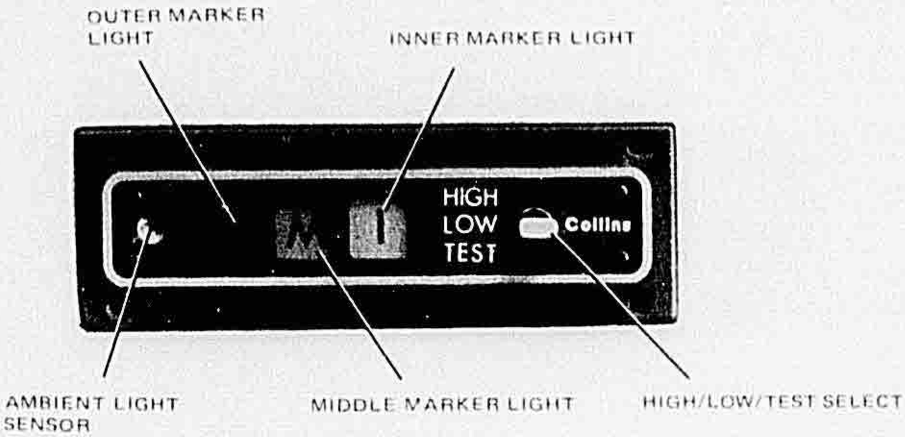
The COM 1/COM 2/EXT control routes microphone keying and audio information to its appropriate destination and switches the output of the isolation amplifier to one of two speakers. In the COM 1 or COM 2 position, microphone information is routed to the appropriate transceiver. Selection of the EXT position routes microphone information to the ramp hailer or passenger address speakers.

3.2.3.2 AUTO Control

The AUTO control switch is used in conjunction with the COM 1/COM 2/EXT select switch. Basically, the AUTO control eliminates the constant switching of the COM 1 and COM 2 control switches when switching back and forth between transmitters. For normal operation of the AUTO control switch, both COM 1 and COM 2 control switches must be in their center positions. The audio from the transceiver, selected by the COM 1/COM 2/EXT select switch, will now be routed to the cabin speaker or headphones depending upon the position of the AUTO control switch.

3.2.3.3 COM 1, COM 2, NAV 1, NAV 2, ADF, DME, and MKR Controls

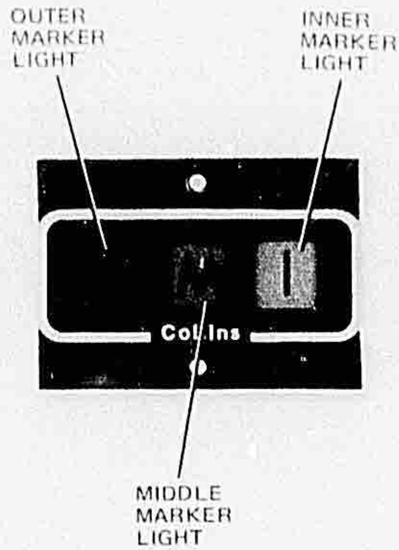
These control switches are used to route the audio from the selected unit into the cabin speaker or headphones. Controls are off when the center position is selected.



MKR-350 Marker Receiver, Controls and Indicators
Figure 3-1

Table 3-1. MKR-350 Marker Receiver, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
HIGH/LOW/TEST select	Controls receiver sensitivity and tests marker lights
Outer marker light (O)	Indicates passage of outer marker
Middle marker light (M)	Indicates passage of middle marker
Inner marker light (I)	Indicates passage of inner marker
Ambient light sensor	Controls brightness of marker lights by monitoring the ambient light level in the cockpit

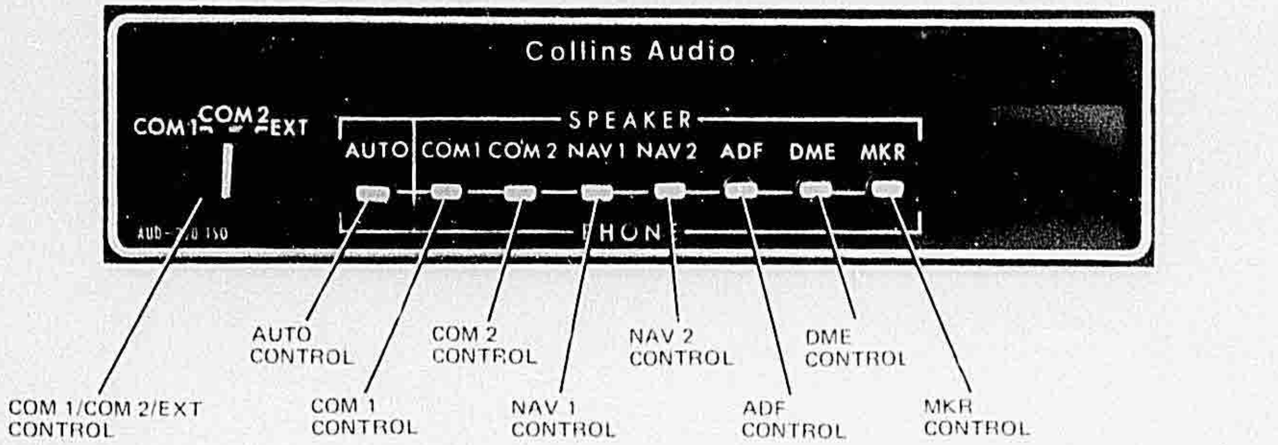


628 6165 001
TP4-5224-017

MKL-351 Remote Marker Lights, Controls and Indicators
Figure 3-2

Table 3-2. MKL-351 Remote Marker Lights, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
Outer marker light (O)	Indicates passage of outer marker
Middle marker light (M)	Indicates passage of middle marker
Inner marker light (I)	Indicates passage of inner marker



AUD-250 Audio Panel, Controls and Indicators
Figure 3-3

Table 3-3. AUD-250 Audio Panel, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
COM 1/COM 2/EXT control	Routes microphone keying and audio information and switches output of isolation amplifier to cabin or ramp hailer speakers.
AUTO control	Automatic control of transceiver audio switching.
COM 1, COM 2, NAV 1, NAV 2, ADF, DME, and MKR controls	Route audio from selected unit into the cabin speaker or headphones.

3.2.4 AMR-350 Audio/Marker Panel (Refer to figure 3-4.)

3.2.4.1 Outer/Middle/Inner Marker Lights

The marker lights provide the pilot with a visual indication of marker beacon passage. Upon passage of a marker beacon station, the appropriate marker light will be illuminated.

3.2.4.2 MARKER HIGH/LOW/TEST Select

The MARKER HIGH/LOW/TEST select control allows the pilot to control marker receiver sensitivity and perform a lamp test on all marker lights. When in the HIGH position, receiver sensitivity is increased to a 200-μV level. Operation in this mode is normally used for enroute flight. An aircraft flying at a high altitude or slightly off course may fail to receive the marker signal in the LOW position. The MARKER HIGH/LOW/TEST select control may be placed in the HIGH position until the signal is received. At this time, switching to LOW will decrease the duration of reception that, in turn, produces a more accurate measure of passage. Operation in the LOW position is typically used when making an approach. Flight in the HIGH sensitivity position therefore gives the pilot an advance indication upon approaching the outer marker. With the AMR-350 in the HIGH position, aural reception will begin about 1.6 kilometres (1 mile) from the center of the outer marker.

3.2.4.3 COM 1/COM 2/EXT Control

The COM 1/COM 2/EXT control routes microphone keying and audio information to its appropriate destination and switches the output of the isolation amplifier to one of two speakers. In the COM 1 or COM 2 position, microphone information is routed to the appropriate transceiver. Selection of the EXT position routes microphone information to the ramp hailer or passenger address speakers.

3.2.4.4 AUTO Control

Basically, the AUTO control eliminates the constant switching of the COM 1 and COM 2 control switches when switching back and forth between transmitters. The AUTO control switch is used in conjunction with the COM 1/COM 2/EXT select switch. For normal operation of the AUTO control switch, both COM 1 and COM 2 control switches must be in their center positions. The audio from the transceiver, selected by the COM 1/COM 2/EXT select switch, will now be routed to the cabin speaker or headphones depending upon the position of the AUTO control switch.

3.2.4.5 COM 1, COM 2, NAV 1, NAV 2, ADF, DME, and MKR Controls

These control switches are used to route the audio from the selected unit into the cabin speaker or headphones. Controls are in the off position when the center position is selected.

3.2.5 AUD-250H Audio Panel (Refer to figure 3-5.)

3.2.5.1 HF/VHF 1/VHF 2/EXT Control

The HF/VHF 1/VHF 2/EXT control routes microphone keying and audio information to its appropriate destination and switches the output of the isolation amplifier to one of two speakers. In the HF, VHF 1, or VHF 2 position, microphone information is routed to the appropriate transceiver. Selection of the EXT position routes microphone information to the ramp hailer or passenger address speakers.

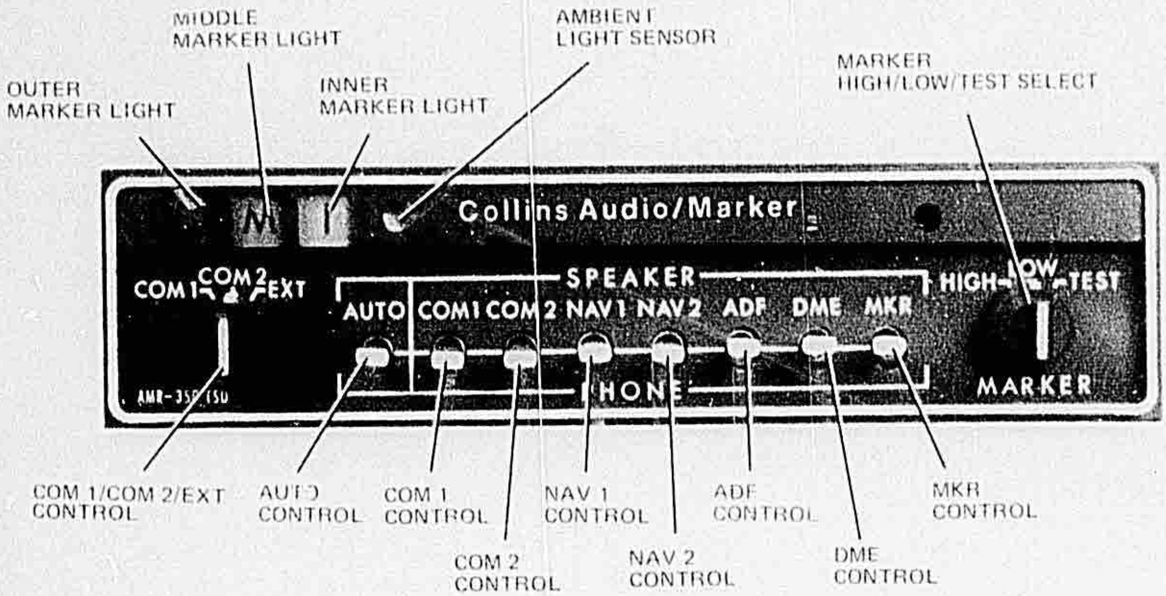
3.2.5.2 HF, VHF 1, VHF 2, NAV 1, NAV 2, ADF 1, ADF 2, and MKR Controls

These control switches are used to route the audio from the selected unit into the cabin speaker or headphones. Controls are off when the center position is selected.

3.2.5.3 SP/OFF/PH Control

The SP/OFF/PH control is used in conjunction with the HF/VHF 1/VHF 2/EXT control. Basically, this control eliminates the constant switching of the HF, VHF 1, and VHF 2 control switches when switching back and forth between transmitters.

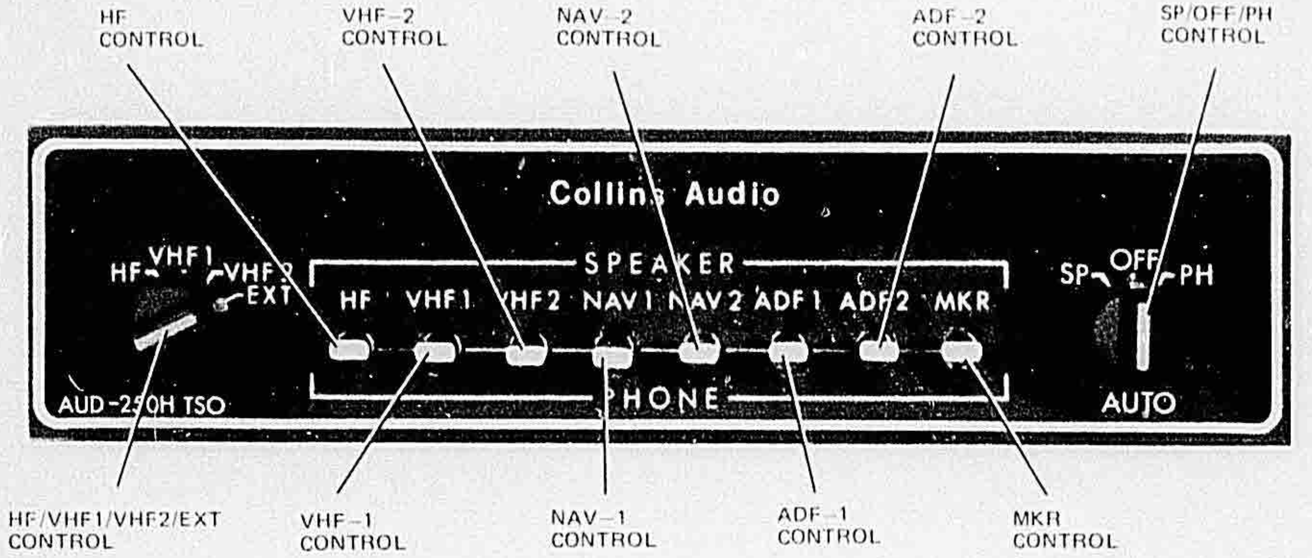
For normal operation of the SP/OFF/PH control, the HF, VHF 1, and VHF 2 control switches must be in their center positions. The audio from the transceiver, selected by the HF/VHF 1/VHF 2/EXT control, will now be routed to the cabin speaker or headphones depending upon the position of the SP/OFF/PH control.



AMR-350 Audio/Marker Panel, Controls and Indicators
Figure 3-4

Table 3-4. AMR-350 Audio/Marker Panel, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
Outer marker light (O)	Indicates passage over outer marker.
Middle marker light (M)	Indicates passage over middle marker.
Inner marker light (I)	Indicates passage over inner marker.
MARKER HIGH/LOW/ TEST select	Controls receiver sensitivity and tests marker lights.
COM 1/COM 2/EXT control	Routes microphone keying and audio information and switches output of isolation amplifier to cabin or ramp hailer speakers.
AUTO control	Automatic control of transceiver audio switching.
COM 1, COM 2, NAV 1, NAV 2, ADF, DME, and MKR controls	Route audio from selected unit into the cabin speaker or headphones.
Ambient light sensor	Automatically controls brightness of marker lights by monitoring the ambient light level in the cockpit.



AUD-250H Audio Panel, Controls and Indicators
Figure 3-5

Table 3-5. AUD-250H Audio Panel, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
HF/VHF 1/VHF 2/EXT control	Routes microphone keying and audio information, and switches output of isolation amplifier to cabin or ramp speakers.
HF, VHF 1, VHF 2, NAV 1, NAV 2, ADF 1, ADF 2, and MKR controls	Route audio from selected unit into the cabin speaker or headphones.
SP/OFF/PH control	Automatic control of transceiver audio switching.

3.2.6 AMR-350H Audio/Marker Panel (Refer to figure 3-6.)

3.2.6.1 Outer/Middle/Inner Marker Lights

The marker lights provide the pilot with a visual indication of marker beacon passage. Upon passage of a marker beacon station, the appropriate marker light will be illuminated.

3.2.6.2 MARKER HIGH/LOW/TEST Select

The MARKER HIGH/LOW/TEST select control allows the pilot to control marker receiver sensitivity and perform a lamp test on all marker lights. When in the HIGH position, receiver sensitivity is increased to a 200-μV level. Operation in this mode is normally used for enroute flight. An aircraft flying at a high altitude or slightly off course may fail to receive the marker signal in the LOW position. The MARKER HIGH/LOW/TEST select control may be placed in the HIGH position until the signal is received. At this time, switching to LOW will decrease the duration of reception that, in turn, produces a more accurate measure of passage. Operation in the LOW position is typically used when making an approach. Flight in the HIGH sensitivity position therefore gives the pilot an advance indication upon approaching the outer marker. With the AMR-350H in the HIGH position, aural reception will begin about 1.6 kilometres (1 mile) from the center of the outer marker.

3.2.6.3 HF/VHF 1/VHF 2/EXT Control

The HF/VHF 1/VHF 2/EXT control routes microphone keying and audio information to its appropriate destination and switches the output of the isolation amplifier to one of two speakers. In the HF, VHF 1, or VHF 2 position, microphone information is routed to the appropriate transceiver. Selection of the EXT position routes microphone information to the ramp hailer or passenger address speakers.

3.2.6.4 HF, VHF 1, VHF 2, NAV 1, NAV 2, ADF 1, ADF 2, and MKR Controls

These control switches are used to route the audio from the selected unit into the cabin speaker or headphones. Controls are in the off position when the center position is selected.

3.2.7 AUD-251H Audio Panel (Refer to figure 3-7.)

Note

Aircraft in which the cabin speaker is not wired should always contain an emergency headphone jack. The pilot should know the jack location and be familiar with AUD-251H operation in the event of headphone amplifier failure. Should the headphone amplifier fail, the pilot should immediately connect his headset to the emergency jack. Received audio is selected by placing the desired receiver toggle switch in the SPEAKER position.

3.2.7.1 VHF 1/VHF 2/HF/EXT Control

The VHF 1/VHF 2/HF/EXT control routes the audio of the aircraft microphone to the selected destination and switches the output of the speaker amplifier between the cabin and passenger address/ramp speakers. In the HF, VHF 1, or VHF 2 position, microphone information is routed to the selected transceiver. Selection of the EXT position directs the output of the speaker amplifier into the ramp hailer or passenger address speakers.

3.2.7.2 VHF 1, VHF 2, HF, NAV 1, NAV 2, ADF, DME, and MKR Controls

These control switches are used to route audio from the selected unit into the cabin speaker or headphones. Controls are off when the center position is selected.

3.2.7.3 SP/OFF/PH Control

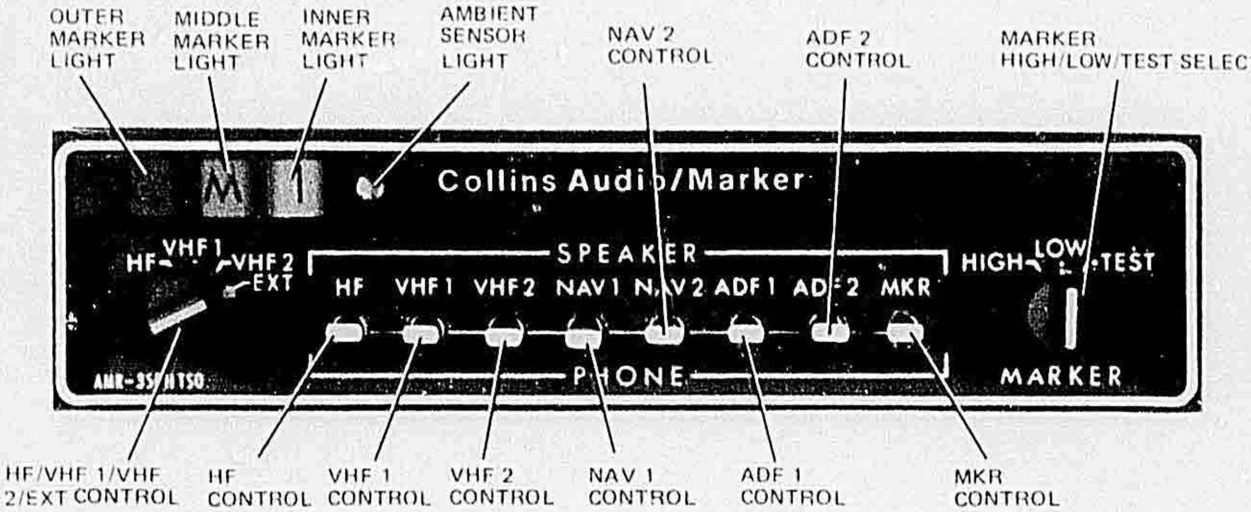
The SP/OFF/PH control is used in conjunction with the HF/VHF 1/VHF 2/EXT control. Basically, this control eliminates the constant switching of the VHF 1, VHF 2, and HF control switches when switching back and forth between transmitters.

For normal operation of the SP/OFF/PH control, the VHF 1, VHF 2, and HF control switches must be in their center (off) positions. The audio from the transceiver, selected by the VHF 1/VHF 2/HF/EXT control, will now be routed to the cabin speaker or headphones, depending upon the position of the SP/OFF/PH control.

3.3 OPERATION

3.3.1 MKR-350 Marker Receiver and MKL-350/351 Remote Marker Lights

Marker beacon receivers are used to provide the pilot with accurate position fixes on airways and ILS approach courses. Generally, three types of marker beacons are used and are identified as inner marker, middle marker, and outer marker.



AMR-350H Audio/Marker Panel, Controls and Indicators
Figure 3-6

Table 3-6. AMR-350H Audio/Marker Panel, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
HF/VHF 1/VHF 2/NAV 1/NAV 2/ADF 1/ADF 2/ MKR control	Routes microphone keying and audio information, and switches output of isolation amplifier to cabin or ramp hailer speakers.
Outer marker light (O)	Indicates passage over outer marker.
Middle marker light (M)	Indicates passage over middle marker.
Inner marker light (I)	Indicates passage over inner marker.
HF, VHF 1, VHF 2, NAV 1, NAV 2, ADF 1, ADF 2, and MKR controls	Route audio from selected unit into the cabin speaker or headphones.
Ambient light sensor	Automatically controls brightness of marker lights by monitoring the ambient light level in the cockpit.

AUD-251H Audio Panel, Controls and Indicators
Figure 3-7

Table 3-7. AUD-251H Audio Panel, Controls and Indicators.

CONTROL OR INDICATOR	FUNCTION
VHF 1/VHF 2/HF/EXT control	Routes microphone keying and audio information to the selected destination.
VHF 1, VHF 2, HF, NAV 1, NAV 2, ADF, DME, and MKR controls	Provide three selectable positions that route received audio to cabin speaker or headphones, or block passage to both.
AUTO control	Provides automatic control of transceiver audio switching.

Markers are used in conjunction with radio instrument landing systems. The outer marker is normally positioned on the front localizer course near the point where the glideslope approach path intersects the minimum inbound altitude after the procedure turn. The 75-MHz carrier frequency is projected vertically in an elliptical cone-shaped pattern and is modulated at 400 Hz. The outer marker is keyed to emit dashes at a rate of two per second. Passage over the outer marker keys the marker receiver that causes the O, blue lamp to flash on and off two times per second and apply a 400-Hz dashed tone to the audio system.

The middle marker is normally located on the front localizer course approximately 0.97 km (0.6 mi) from the approach end of an ILS runway. The radiated pattern is similar to that of the outer marker; however, the middle marker is modulated at a 1300-Hz rate and is keyed to emit alternate dots and dashes. Passage over the middle marker causes the M, amber lamp to flash on and off synchronously with the emitted beacon signal. A 1300-Hz keyed audio tone will also be present in the audio system.

The inner marker is located close to the front course approach end of the runway. The marker carrier frequency is modulated with 3000 Hz.

Passage over the inner marker causes the I, white lamp to light. The 3000-Hz modulating frequency tone will be present in the audio system.

The MKR-350 enables the pilot to control receiver sensitivity. It is recommended the control be placed in the HIGH position when enroute. Prior to making an approach, the LOW position should be selected. Switching to the LOW sensitivity position will decrease the duration of marker reception thus producing a more accurate measure of passage.

As a preflight test of marker light operation, the TEST position is selected. This places lights within the MKR-350 at full intensity. Remote marker lights, such as the MKL-350/351, will also be placed at full intensity when the TEST position is selected.

Caution

This equipment has been designed to exhibit a very high degree of functional integrity. Nevertheless, users must recognize that it is not practical to provide monitoring for all conceivable system failures and that, however unlikely, it is possible that erroneous operation could occur without a fault indication. The pilot has the responsibility to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

3.3.2 AUD-250/250H Audio Panel

The AUD-250/250H Audio Panel provides both transmitting and audio distribution functions controllable from the unit front panel. The major functional controls consist of a microphone selector switch and receiver audio selector switches.

Note

When operating the AUD-250 Audio Panel, incorrectly positioning the COM 1 or COM 2 toggle switches to their PHONE position when operating in the AUTO SPEAKER mode may result in an unexpected audio source being heard over the speaker. If any of the input control switches (NAV, ADF, DME, or MKR) are set to the PHONE position, audio from that radio will be heard at full volume over the speaker. As an example, if the AUTO switch connects COM 1 to the speaker and the COM 1 switch is in the PHONE position, then any other source switched to PHONE will be coupled to COM 1 and will be heard in the speaker. To prevent this, simply remember to set both COM switches to their center position when using the AUTO function for speaker.

When operating the AUD-250H Audio Panel, a similar situation exists when the AUTO control is set in the SP position. If the HF, VHF 1, and VHF 2 toggle switches are in their PHONE positions, audio will be coupled into the aircraft speaker when the PHONE position is selected on any other control toggle. Again, remembering to set the HF and VHF control switches to their center position when operating in AUTO will prevent this from occurring.

Another characteristic common to both units is audio output level reduction with multiple inputs selected for phones. That is, the greater the number of toggle controls switched out of the center position, the lower the audio output level will become. Normally, no more than two or three audio functions should be monitored continuously. To prevent level reduction, remember to switch off each control when not in use.

The microphone selector switch COM 1/COM 2/EXT (HF/VHF 1/VHF 2/EXT on AUD-250H) routes microphone keying and audio information to its appropriate destination and switches the output of the isolation amplifier to one of two speakers. Selection of COM 1 or COM 2 (HF, VHF 1, or VHF 2 in AUD-250H) routes microphone information to the selected transceiver. Selection of the EXT position routes microphone information to a ramp hailer or passenger address system. If neither ramp hailer nor PA functions are desired, the isolation amplifier may be used for communication between the pilot and copilot. Regardless of the microphone selector position, muting of the receiver inputs will occur whenever a microphone is keyed.

Eight three-position toggle switches are used to control its inputs to the isolation amplifier. All switches are off when the center position is selected. When the up SPEAKER position is selected, the audio input of the selected receiver will be applied to the isolation amplifier that drives the cockpit speaker. In the down PHONE position, the receiver audio bypasses the isolation amplifier and is applied directly to the headphones.

The AUTO control switch (or SP/OFF/PH control in AUD-250H) is used in conjunction with the microphone selector switch. This control feature eliminates the constant switching of the COM 1 and COM 2 control switches when switching back and forth between transceivers. For normal control operation, both COM 1 and COM 2 controls must be off (HF, VHF 1, VHF 2 on AUD-250H). The transmitted audio, selected by the microphone selector control, will now be routed to the cabin speaker or headphones depending upon the position of the AUTO control switch.

Caution

This equipment has been designed to exhibit a very high degree of functional integrity. Nevertheless, users must recognize that it is not practical to provide monitoring for all conceivable system failures and that, however unlikely, it is possible that erroneous operation could occur without a fault indication. The pilot has the responsibility to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

3.3.3 AMR-350/350H Audio/Marker Panel

The AMR-350 combines the MKR-350 Marker Receiver and AUD-250 Audio Panel into a single panel-mounted unit. The AMR-350H combines the functions of the MKR-350 and AUD-250H (with the exception of the SP/OFF/PH control). Operating techniques and procedures are obtained by combining paragraph 3.3.1 with paragraph 3.3.2.

Note

When operating the AMR-350 Audio/Marker Panel, incorrectly positioning the COM 1 or COM 2 toggle switches to their PHONE position when operating in the AUTO SPEAKER mode may result in an unexpected audio source being heard over the speaker. If any of the input control switches (NAV, ADF, DME, or MKR) are set to the PHONE position, audio from that radio will be heard at full volume over the speaker. As an example, if the AUTO switch connects COM 1 to the speaker, and the COM 1 toggle switch is in the PHONE position, then any other source switched to the PHONE position will be coupled to COM 1 and will be heard in the speaker. To prevent this, simply remember to set both COM switches to their center position when using the AUTO position for speaker.

When operating the AMR-350H Audio/Marker Panel a similar situation exists when the AUTO control is set in the SP position. If the HF, VHF 1, and VHF 2 toggle switches are in their PHONE positions, audio will be coupled into the aircraft speaker when the PHONE position is selected on any other control toggle. Again, remembering to set the HF and VHF control switches to their center position when operating in AUTO will prevent this from occurring.

Another characteristic common to both units is audio output level reduction with multiple inputs selected for phones. That is, the greater the number of toggle controls switched out of their center position, the lower the audio output level will become. Normally, no more than two or three audio functions should be monitored continuously. To prevent level reduction, remember to switch off each control when not in use.

Caution

This equipment has been designed to exhibit a very high degree of functional integrity. Nevertheless, users must recognize that it is not practical to provide monitoring for all conceivable system failures and that, however unlikely, it is possible that erroneous operation could occur without a fault indication. The pilot has the responsibility to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

3.3.1 AUD-251H Audio Panel

The AUD-251H Audio Panel is an extremely flexible and efficient cockpit tool that, when used correctly, greatly reduces pilot workload. The primary function of the panel is to provide audio control, including amplification, switching, and destination routing.

Power is applied to the AUD-251H when the aircraft master switch is turned on. To monitor a particular signal, position the appropriate toggle switch, or switches, up for speaker or down for headphones. The center, OFF, position prevents received audio from reaching either speaker or phones.

To enhance operation and simplify switching, the AUTO control should be used. Basically, this control is used in conjunction with the VHF 1/VHF 2/HF/EXT (microphone selector) control and provides automatic audio switching that tracks the transceiver selected by the microphone selector switch. To activate the AUTO control, the pilot first positions the VHF 1, VHF 2, and HF toggle switches to the center, off, position. Next, the AUTO control is used to select the audio destination (speaker or headphones). With these initial tasks completed, the audio from the transceiver selected by the VHF 1/VHF 2/HF/EXT control will be present in the speaker or headphone as determined by the AUTO control.

Theory

MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

Rockwell International

theory

Printed in USA

523-0766039-004118
4th Edition, 9 June 1982

MKR-350, MKL-350/351, AUD-250/250H/251H, AMR-350/350H

523-0766039-004118

table of contents

NOTICE: This section replaces third edition dated 15 June 1976.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change

Page No	Issue
*Title	9 Jun 82
*List of Effective Pages	9 Jun 82
4-1 thru 4-4	15 Jun 76
*4-5	9 Jun 82
4-6	15 Jun 76

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL,
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None				
2nd Ed	1 Sep 75		None				
3rd Ed	15 Jun 76		None				
4th Ed	9 Jun 82		None				

section IV
theory

4.1 GENERAL

This section presents a general description of the marker beacon system and a functional level description of circuit operation for each unit.

4.2 MARKER BEACON PRINCIPLES (Refer to figure 4-1.)

Instrument landing system marker beacon transmitters operate on a fixed frequency of 75 MHz. Marker beacons provide fixes along the front-course approach path.

The outer marker is approximately 7.4 km (4.6 mi) from the runway. The 75-MHz signal from the outer marker is amplitude modulated with 400 Hz and keyed to emit dashes (approximately 1.5 seconds long) for identification. The middle marker is approximately 0.97 km (0.6 mi) from the runway, and is amplitude modulated with alternate dots (approximately 0.5 second long) and dashes at 1300 Hz. Category II instrument landing systems include inner markers approximately 0.4 km (1/4 mi) from the runway. These are modulated with dots at 3000 Hz. The exact locations of markers for particular airports are given in the Airman's Information Manual discussion of instrument approach procedures.

4.3 PRINCIPLES OF OPERATION

4.3.1 Block Diagram Principles of Operation

4.3.1.1 MKR-350 Marker Receiver (Refer to figure 4-2.)

Signals that are received by the marker beacon antenna are applied through a selective LC filter network to mixer Q1. The 75-MHz marker beacon signal is mixed with an 85.7-MHz crystal oscillator signal to produce an output of 10.7 MHz.

This if signal is crystal filtered and amplified by two integrated circuit amplifiers. A single-stage AGC circuit controls the if amplifier gain.

The amplified if signal is applied to the detector and AGC amplifier. The detected audio signal is amplified and applied to three active filters that are resonant at 400, 1300, and 3000 Hz. When an audio signal is present at one of these frequencies, the corresponding resonant circuit passes the audio signal to a lamp driver that in turn illuminates the selected light.

The detected audio is also applied to the audio output circuitry that provides 5 mW output into a 500-ohm load.

A photocell located on the unit front panel senses the cockpit ambient light level and controls the conduction of the lamp dimmer circuit. This arrangement adjusts the brightness of the marker lamps to an optimum level for all cockpit lighting conditions.

High- or low-sensitivity operation is controlled by switch-selected mixer bias networks.

Power is supplied to the MKR-350 by a series regulator that produces the required stable dc voltage for operation.

4.3.1.2 MKL-350/351 Remote Marker Lights

The MKL-350/351 must be driven by the MKR-350 Marker Receiver or AMR-350/350H Audio/Marker Panel. Dimming of the MKL-350/351 marker lamps is controlled by the unit containing the marker receiver.

4.3.1.3 AUD-250/250H Audio Panel

The AUD-250 provides isolation amplification and audio switching functions. Inputs are provided for two transceivers, two navigation receivers, adf, DME, and marker beacon receiver. The AUD-250 also switches microphone audio and keying. An AUTO mode allows the microphone selector to control COMM audio outputs.

The AUD-250H also provides isolation amplification and audio switching functions. Inputs provided are for an hf transceiver, two vhf transceivers, two navigation receivers, two automatic direction finders, and marker beacon receiver. Switching microphone audio and keying, as well as an AUTO control, are included in the AUD-250H. The AUTO control allows the microphone selector switch to control transceiver audio outputs.

4.3.1.4 AUD-251H Audio Panel

The AUD-251H Audio Panel provides isolation amplification, audio switching, and intercom functions. Inputs are provided for an hf transceiver, two vhf transceivers, two navigation receivers, an automatic direction finder, a DME, and a marker beacon receiver. The AUD-251H also switches microphone audio and keying. An automatic mode allows the microphone selector to control communication transceiver audio outputs. The AUD-251H is specifically designed for use in helicopters and fixed-wing aircraft in which intercom between crew members is required or in which high ambient noise levels necessitate large headphone drive capability. The AUD-251H supplies not less than 5 watts audio power to the speaker and not less than 8 V rms to the headphone output. Each amplifier is supplied power by an independent power supply to eliminate the complete loss of audio control in the event of an amplifier failure; power inputs should be independently fused. All inputs are isolated with automatic muting provided to prevent acoustical feedback when a transmitter is keyed.

4.3.1.5 AMR-350/350H Audio/Marker Panel

The AMR-350 provides all marker beacon functions, isolation amplification, and audio switching functions. Inputs are provided for two transceivers, two navigation receivers, adf, and DME. High- and low-sensitivity control of the marker receiver is provided. Refer to paragraph 4.3.1.1 for marker receiver block diagram principles of operation.

The AMR-350 also switches microphone audio and keying. An AUTO mode allows the microphone selector to control COMM audio outputs.

The AMR-350H provides all marker beacon functions, isolation amplification, and audio switching functions as does the AMR-350; however, inputs provided are for an hf transceiver, two vhf transceivers, two navigation receivers, and two automatic direction finders. High- and low-sensitivity control of the marker receiver is provided. The AMR-350H does not contain the AUTO mode function.

4.3.2 Detailed Principles of Operation

4.3.2.1 MKR-350 Marker Receiver Operation (Refer to figure 6-1.)

4.3.2.1.1 Input Filter

The triple-tuned input filter consists of three capacitively coupled parallel circuits tuned to 75 MHz. The filter selects marker beacon signals, rejects image frequency signals, and blocks the 85.7-MHz oscillator signal from the antenna.

4.3.2.1.2 Mixer

The 75-MHz marker beacon signal passed by the input filter is applied to gate number 1 of the dual-gate MOSFET mixer Q1. The local oscillator input to gate 2 modulates the transfer characteristic of gate 1, which provides high conversion gain. The 10.7-MHz mixer output is applied to two crystal filters centered at 10.7 MHz.

4.3.2.1.3 IF Amplifier and Detector

After filtering, the 10.7-MHz signal is coupled through a tuned tank circuit to the input of the first if amplifier U1. The output of U1 is capacitively coupled to the second if amplifier U2 for further amplification. The AGC amplifier controls the gain of both if amplifiers. The amplified if signal is coupled through a fixed-tuned tank circuit to detector diode CR2. Diode CR1 temperature compensates the bias network of detector amplifier U3A for stable operation.

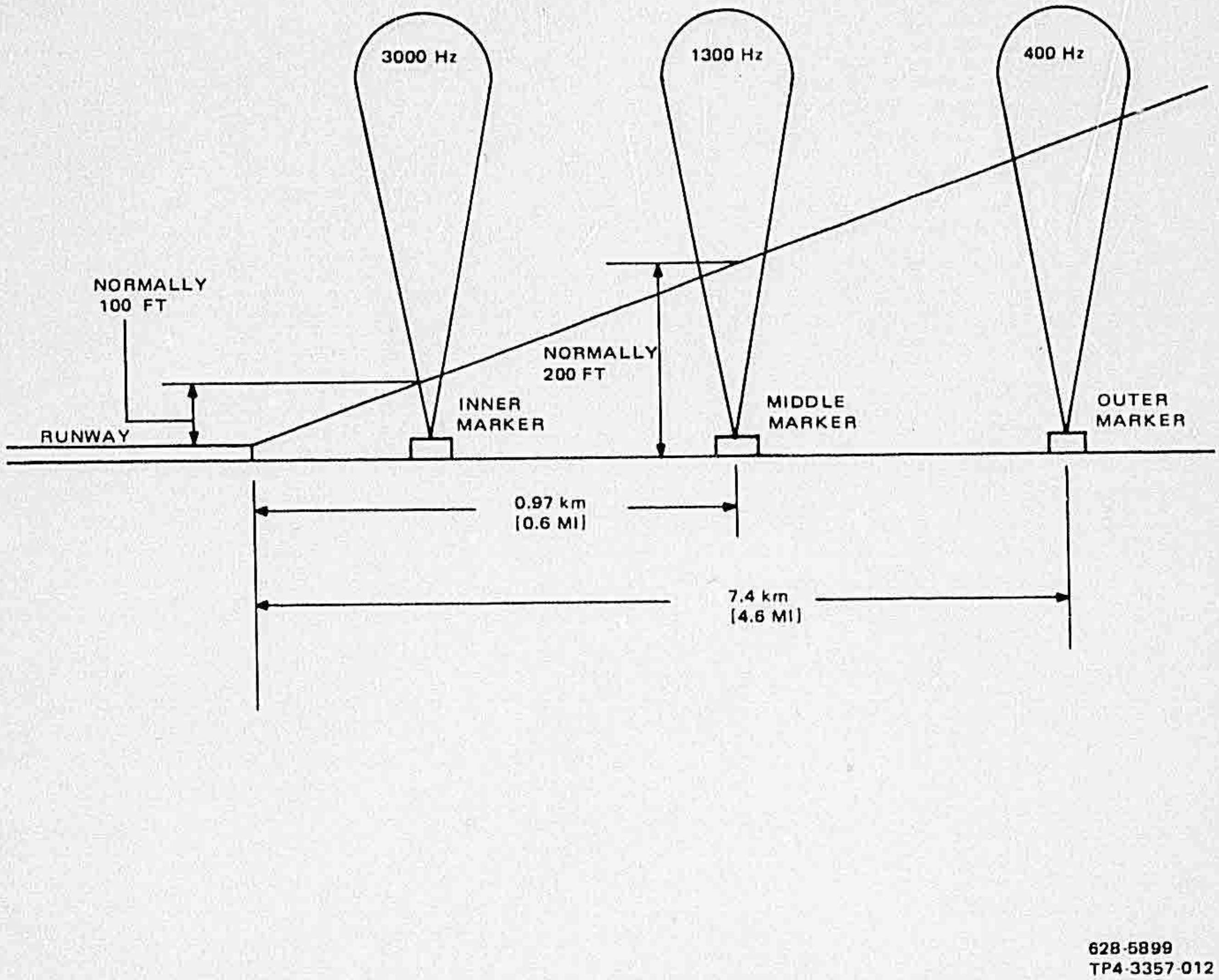
4.3.2.1.4 AGC Amplifier

The output of detector amplifier U3A is applied to AGC amplifier U3B. Feedback capacitor C32 removes audio signals, making the output of the amplifier a dc level proportional to the received signal level. The output of U3B controls the gain of if amplifiers U1 and U2.

4.3.2.1.5 Sensitivity Control

The HIGH/LOW sensitivity switch controls mixer bias. In the LOW position, potentiometer R13 is not used, therefore LOW SENS adjustment R12 sets the mixer bias. This control is factory adjusted for 1000-μV sensitivity.

In the HIGH position, the sensitivity selector switch connects potentiometer R13 to the bias line. The relatively high resistance of resistor R9 isolates the



Location of Marker Beacons
Figure 4-1

LOW SENS pot from the bias line, making the bias level on the mixer a function of HIGH SENS pot R13. This control is factory adjusted for 200-μV sensitivity.

4.3.2.1.6 Audio Amplifier

The audio output of detector amplifier U3A is coupled through capacitor C40 to audio amplifier U4D. Operational amplifier U4D reduces loading of the detector circuit and drives audio output amplifier Q6. The input level to U4D is set by audio gain control potentiometer R45. Audio output transistor Q6 provides 5 mW into a 500-ohm load.

4.3.2.1.7 Lamp Filters and Driver Circuits

Three active filters and corresponding lamp driver circuits select the 400-, 1300-, and 3000-Hz audio tones.

Operational amplifier U4A and its associated components form the 400-Hz filter; U4B, the 1300-Hz filter; and U4C, the 3000-Hz filter. The marker lights are connected between the emitter and ground of each respective driver; blue (400 Hz) to driver Q3, amber (1300 Hz) to Q4, and white (3000 Hz) to Q5. When no signal is received by the marker receiver, transistors Q3, Q4, and Q5 are cut off and no emitter current flows. However, when a marker beacon signal is received, one of the filters produces an output. The filter output is rectified and turns the lamp driver on. The lamp driver switches on and off in step with the modulation keying.

4.3.2.1.8 Automatic Lamp Dimmer

Photocell V1, located on the unit front panel, controls lamp brightness. The photocell senses the ambient light level and varies the base drive applied to transistor Q8. As the ambient light level increases, the resistance of photocell V1 decreases, which increases the base drive of Q8. The increased bias level causes transistor Q8 to conduct more, resulting in greater lamp driver output.

4.3.2.1.9 Lamp Test

A panel-mounted switch is provided for testing marker lamps. When the test position is selected, the +8-V dc power supply output is applied to the anodes of diodes CR11, CR12, and CR13. With these diodes forward biased, full potential is applied to each of the marker lights placing them on at full intensity. Remote lights, if used, will also be tested at full intensity.

4.3.2.1.10 Power Supply

The primary input power is filtered by capacitors C50 and C51 and applied to pass transistor Q9. Zener diode VR2, connected to the base of Q9, provides a stable voltage reference.

4.3.2.2 AUD-250/250H/251H Audio Panel Operation (Refer to figures 6-1, 6-6, and 6-8.)

4.3.2.2.1 Audio Switching

Each audio input is applied to one of eight single-pole, 3-position toggle switches. The center position of each switch is the off condition. Selection of the SPEAKER (up) position routes the applied audio to an impedance matching isolation network that maintains a 500-ohm load impedance on each input regardless of the number of inputs applied to the panel. Selection of the PHONE (down) position feeds the audio output of the desired unit directly to the aircraft headphones without any type of audio processing or amplification. This ensures full use of external equipment in the event of an audio panel failure.

4.3.2.2.2 Microphone Selection and Audio Muting

Rotary switch S101 connects the microphone to the desired transmitter, or to a ramp hailer or passenger address system. Toggle switch S102 (rotary switch S110 in AUD-250H/251H), labeled AUTO, may be used to automatically connect the audio output of the selected transmitter to the speaker or headphone bus.

In the AUD-250H/251H, a fourth function added to microphone selector switch S101 provides for switching the microphone to an hf transceiver.

Diodes CR205 and CR206 (and CR204 in AUD-250H/251H) isolate the transceiver keying lines to prevent interactions.

Grounding a key line mutes the audio amplifier. A grounded key line grounds the cathode of diode CR202 or CR203 (or CR201 in AUD-250H/251H). Current through the diode and resistor R216 shunts bias current away from amplifier transistor Q201, turning it off.

4.3.2.2.3 Speaker Amplifier

Inputs to the speaker amplifier are applied to preamplifier transistor Q201. The output of Q201 is applied to emitter follower Q202, which provides impedance matching to the base of phase splitter Q203. The signals at the collector and emitter of Q203 are equal in amplitude and 180 degrees out of phase to drive the Darlington push-pull output. The output amplifier, Q204, Q205, Q102, and Q103, (Q204 and Q205 in AUD-251H), operates in the class B mode, with diodes CR207 and CR208 establishing the bias level to minimize crossover distortion. The output transformer is tapped to deliver a minimum of 5 watts to a 3.2-ohm cockpit speaker or to an 8-ohm ramp hailer.

4.3.2.2.4 Headphone Amplifier (AUD-251H Only)

Inputs are provided for as many as five intercom microphone inputs with the amplifier providing at least 8 V rms into five 500-ohm headsets; inputs applied simultaneously are mixed and amplified.

The headphone amplifier will become operational upon application of the primary input power. The primary input is regulated by pass transistor Q301 that supplies the enabling logic to the quad bilateral switch pack U301 and bias voltage to the headphone amplifier. The positive dc voltage at pin 14 of U301 causes all switches to close thereby allowing audio from the selected source to pass and be amplified. Amplified audio in this state will consist of ICS mic inputs (mixed when conditions exist) and/or audio from selected receivers. Keying the aircraft microphone places a ground on the XMIT KEYLINE input, which in turn forward biases diode CR301. With CR301 forward biased, U301 control input pins 12, 13, and 5 will go low opening their respective switch segments. Control input pin 6, however, will remain high and allow sidetone audio from the keyed transceiver to pass into the headphone amplifier. To summarize therefore, keying a transmitter mutes all ICS mic inputs and receiver audio inputs allowing only sidetone passage while transmitting. The pin 11 output of U301 is directed back into the CMOS to provide a uniform on-state resistance with varying audio input levels and in addition performs an inverting function to facilitate switch operation.

The output of quad switch pack U301 is preamplified by U302 before being applied to the final stage consisting of a complementary-symmetry amplifier. This configuration eliminates the need for complex drive circuitry while still maintaining a minimum of 8 V rms at the output of T301.

4.3.2.2.5 Speaker Amplifier Power Supply

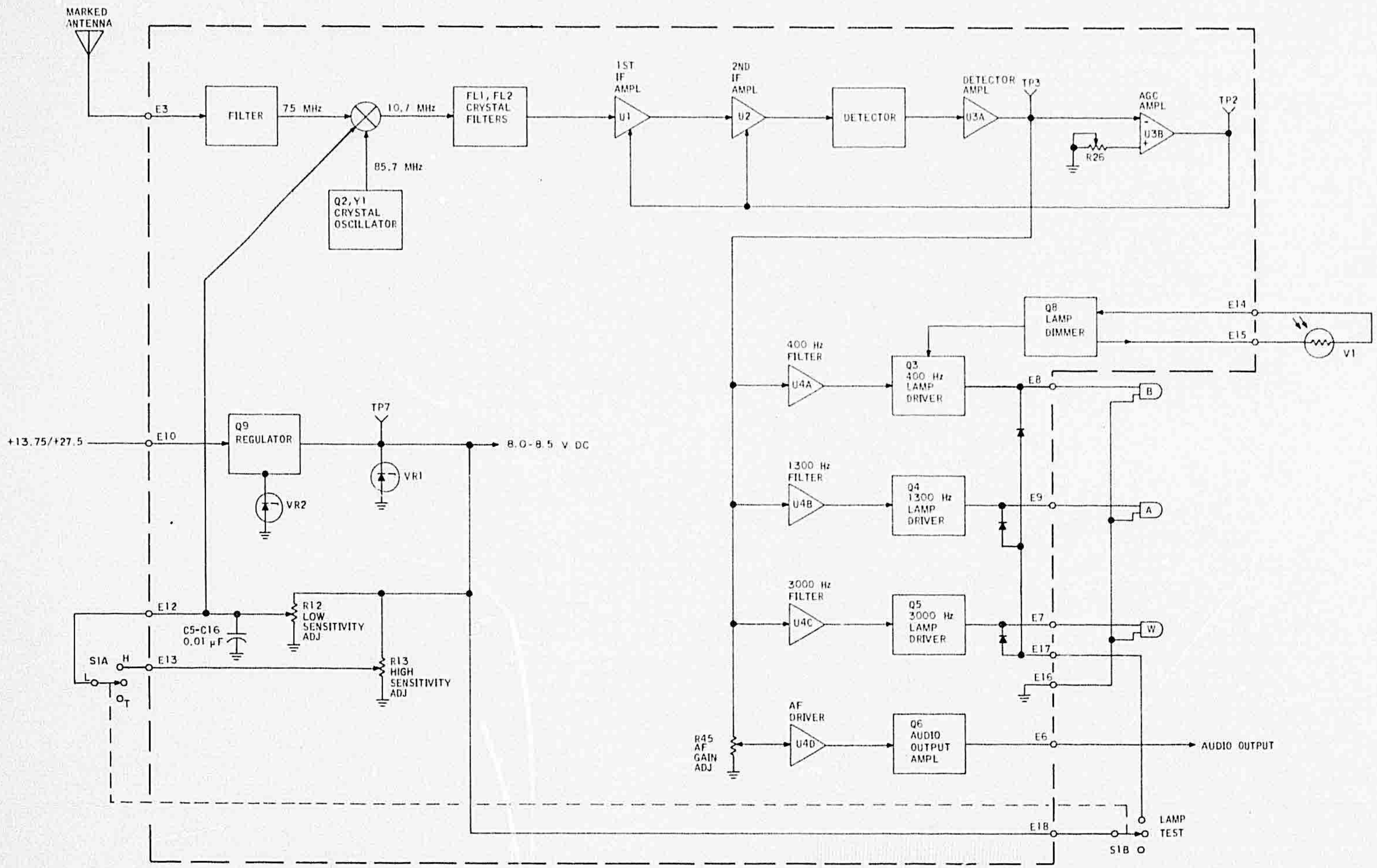
The primary power input is filtered by capacitors C213 and C214 and applied to pass transistor Q101. Zener diode VR201, connected to the base of Q101, provides a stable voltage reference.

4.3.2.2.6 Headphone Amplifier Power Supply

The primary power input is filtered by capacitor C303 and applied to pass transistor Q301. Regulation is accomplished by base-connected zener VR301 that provides the reference voltage.

4.3.2.3 AMR-350/350H Audio/Marker Panel (Refer to figures 6-11 and 6-14.)

The AMR-350 combines the functions of the MKR-350 Marker Receiver and AUD-250 Audio Panel into a single panel-mounted unit. The AMR-350H combines the functions of the MKR-350 Marker Receiver and the AUD-250H Audio Panel. The detailed principles of AMR-350/350H operation are therefore obtained by combining paragraph 4.3.2.1 entitled MKR-350 Marker Receiver Operation with portions of paragraph 4.3.2.2 that are applicable to AUD-250/250H Audio Panel operation.



628-5840
TP4-3165-014

MKR-350 Marker Receiver, Functional Block Diagram
Figure 4-2

Collins MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

Rockwell International

maintenance

Collins General Aviation Division

Printed in USA

523-0766040-105118
5th Edition, 9 June 1982
1st Revision, 30 July 1984

Maintenance

MKR-350, MKL-350/351, AUD-250/250H/251H, AMR-350/350H

523-0766040-105118

table of contents

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Record of Revisions

RETAIN THIS RECORD AND ALL APPLICABLE SB/SIL's. WHEN A NEW OR REVISED BULLETIN IS ISSUED, INSERT A COPY INTO THIS SECTION AND UPDATE THIS TITLE PAGE INDEX. ONLY A REVISED TITLE PAGE WILL BE INCLUDED WITH THE NEXT INSTRUCTION BOOK ISSUE.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None
2nd Ed	1 Sep 75		AMR-350/350H AUD-250/250H SIL 1-75, 2-75 AMR-350H SB 1
3rd Ed	15 Jun 76		Same as above
1	1 Apr 77		All the above plus all audio panels SIL 1-76
	1 Jun 78		All of the above plus MKR-350: SB 1, 2, SIL 1-77, 2-77; AUD-250: SB 1,2,3, SIL 1-77, 2-77; AUD-250H: SB 1,2,3, SIL 1-77, 2-77; AUD-251H: SB 1; AMR-350: SB 1,2,3, SIL 1-77 thru 4-77; AMR-350H: SB 2,3,4, SIL 1-77 thru 4-77
1	15 Jan 79		All of the above plus AMR-350: SB 1; AUD-251H: SIL 1-78
5th Ed	9 Jun 82		MKR-350: SB 3, 4, SIL 1-79; AUD-250: SIL 1-79 AUD-250H: SB 3R1, 4, SIL 1-79; AUD-251H: SB 2, 3R1, 4; AMR-350: SB 2R1, 4, 5R1, 6, SIL 1-79, 2-79, 3-79; AMR-350H: SB 5, 6, 7, 8, SIL 1-79, 2-79, 3-79
1	30 Jul 84		Same as above

section V
maintenance

5.1 GENERAL

This section provides information necessary to maintain, repair, test, and align the MKR-350 Marker Receiver, MKL-350/351 Remote Marker Lights, AUD-250/250H/251H Audio Panel, and AMR-350/350H Audio/Marker Panel.

Table 5-1 lists tools required; tables 5-2, 5-3, and 5-4 are lists of test equipment needed to accomplish alignment and repair of the above units.

5.2 REPLACEMENT OF INTEGRATED CIRCUITS

5.2.1 Troubleshooting and Replacement of MOS/CMOS Devices

All MOS devices are subject to damage by electrostatic charges. The very high resistance of the oxide insulation used within the MOS imposes a negligible load on electrostatic potentials and therefore does not provide an effective discharge path for sources of static electricity. Although some MOS devices do contain integral gate-protection systems, good practice dictates careful handling of all MOS packages. The following precautions should be observed when handling MOS devices and are applicable to both in-circuit and out-of-circuit environments.

Caution

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors, PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of these components contain internal gate protection circuits that are partially effective, but good practice dictates careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

a. Deenergize or disconnect all power and signal sources and loads used with the unit.
b. Place the unit on grounded conductive work surfaces.
c. Ground the repair operator through a conductive wrist strap or other device using a 1-MΩ series resistor to protect the operator.
d. Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

Table 5-1. Tools Required.

DESCRIPTION	CHARACTERISTIC	FUNCTION
20-watt soldering iron	Any.	Remove/replace IC's and components.
Solder sucker	Any.	Used to remove solder.
Needle-nose pliers	Any.	Bend component leads.
Cutting tools	Various, small diagonal cutter, end nippers, etc. (sharp tools that will not leave a burr).	Cut IC and component leads.
Adjustment tool	JFD 5284 or equivalent.	Used to adjust variable resistors.
Adjustment tool	Collins part number 628-7983-001 or fabricate as shown in figure 5-8.	Used to adjust CPN 382-0049-XXX variable resistors.
Screwdrivers	Any.	Disassembly.

Table 5-2. MKR-350 Test Equipment Required.

EQUIPMENT	CHARACTERISTIC REQUIRED
Rf signal generator	Frequency range: Capable of 70 to 80 MHz.
	Rf output range: 2 to 200,000 μV.
	Modulation: 0 to 95%.
Audio signal generator	Frequency range: 300 to 4000 Hz.
	Distortion: 3% maximum.
Audio power meter	Power range: 500 mW full scale.
	Accuracy: ±1.5 dB.
Digital voltmeter	Input impedance: 1 megohm.
Dc power supply	Output: 0 to 16 V dc, 0 to 1 A.
6-dB pad	Attenuation: 6 dB.
	Impedance: 50 ohms.
Audio power meter	Power range: 10 watts maximum.
	Accuracy: ±1.5 dB down to 50 mW.

Table 5-3. AUD-250/250H/251H Test Equipment Required.

EQUIPMENT	CHARACTERISTIC REQUIRED
Audio signal generator	Frequency range: 0 to 5000 Hz.
	Distortion : 3% maximum.
Digital voltmeter	Input impedance: 1 megohm.
Dc power supply	Output: 0 to 16 V dc, 0 to 2 A.
Ac voltmeter	Range: 1.0 mV to 10 V rms.
	Accuracy: ±5% of full scale.
Oscilloscope	Any dc coupled (used for observation only).
Audio power meter	Power range: 10 watts maximum.
	Accuracy: ±1.5 dB down to 50 mW.

Table 5-4. AMR-350/350H Test Equipment Required.

EQUIPMENT	CHARACTERISTIC REQUIRED
Audio signal generator	Frequency range: 0 to 5000 Hz.
	Distortion: 3% maximum.
Digital voltmeter	Input impedance: 1-megohm.
Dc power supply	Output: 0 to 16 V dc, 0 to 2 A.
Ac voltmeter	Range: 1.0 mV to 10 V rms.
	Accuracy: ±5% of full scale.
Oscilloscope	Any dc coupled (used for observation only).
Rf signal generator	Frequency range: Capable of 70 to 80 MHz.
	Rf output range: 2 to 200,000 μV.
	Modulation: 0 to 95%.
6-dB pad	Attenuation: 6 dB.
	Impedance: 50 ohms.
Audio power meter	Power range: 10 watts maximum.
	Accuracy: ±1.5 dB down to 50 mW.

e. All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.
f. When these devices and assemblies are removed from the unit, they should be placed on the conductive work surface or in conductive containers.
g. When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.
h. Do not handle these devices unnecessarily or remove from their packages until actually used or tested.

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

5.2.2 *Replacement Techniques*

Integrated circuits (IC's) are delicate items and should not be replaced until all other defects are eliminated and it is determined that the IC is definitely defective.

Note the orientation of the IC on the board before removal to assure correct placement of the new part. Remove the old IC by clipping each lead on the IC using a small diagonal cutter. Heat the leads with a soldering iron and pull them from the board with needle-nose pliers. Clear excess solder from the holes with a solder sucker. This procedure avoids overheating the circuit board and damaging other components or the board itself.

When soldering new IC into place, avoid excessive heating. Excessive heat may cause internal damage to the IC, making it inoperable. Excessive heat may also damage the circuit board foil. After soldering, use a toothpick to remove any heavy rosin deposits. Solder joints should be smooth, bright, and clean.

5.3 DISASSEMBLY/ASSEMBLY

Caution

ESDS devices are subject to damage by excessive levels of voltage and/or current, just as are more conventional semiconductor devices such as bipolar transistors and TTL logic. However, the precautions normally used to protect semiconductors are not sufficient for the protection of ESDS components. Because of the very high electrical resistance of ESDS devices, these components are susceptible to damage by electrical sources that cannot deliver enough energy to damage conventional semiconductors. The low-energy source that most commonly destroys ESDS devices is the human body, which in conjunction with nonconductive garments and floor coverings generates and retains static electricity.

In order to adequately protect ESDS devices, the device and everything that contacts it must be brought to ground potential by providing a conductive surface and discharge paths.

Specifically, the following precautions must be followed:

a. Deenergize to disconnect all power and signal sources and loads used with the unit.
b. Place the unit on grounded conductive work surface.
c. Ground the repair operator through a conductive wrist strap or other device using a 470-kΩ or 1-MΩ series resistor to protect the operator.
d. Ground any tools, such as soldering equipment, that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.
e. When ESDS devices and assemblies are not in the unit, they should be on the conductive work surface or in conductive containers. When a device or assembly is inserted in or removed from a container, the operator should maintain contact with the conductive portion of the container. Do not use plastic bags unless they have been impregnated with a conductive material.
f. Do not handle ESDS devices unnecessarily or remove them from their packages until actually used or tested.

Warning

This electronic equipment may have components that contain sealed materials (such as beryllium oxide, acids, lithium, radioactive material, mercury, etc) that can be hazardous to your health. If the component enclosure seal is broken, precautions must be taken against personal contact or inhalation, in accordance with OSHA requirements 29CFR 1910.1000, during equipment maintenance, disassembly, or repair.

The simplicity of the equipment described within this instruction book eliminates the need for detailed disassembly/assembly procedures. However, before attempting to disassemble a unit, the exploded view for that particular equipment should be carefully studied. Figures 5-1 through 5-7 are exploded views of the MKR-350, MKL-350/351, AUD-250, AUD-250H, AUD-251H, AMR-350, and AMR-350H respectively.

5.4 TEST EQUIPMENT

Test equipment required for alignment and testing is listed in table 5-2 for the MKR-350 Marker Receiver, table 5-3 for the AUD-250/250H/251H, and table 5-4 for the AMR-350/350H.

5.5 TESTING AND ALIGNMENT PROCEDURES

Two test procedures are provided for each unit; each procedure is unique and designed to provide a specific function. The preliminary checks are provided to ensure proper operation prior to unit installation in the aircraft or after minor repairs are made. The detailed test procedures should be used when attempting to isolate faults and, after repairs have been made, to realign the affected area.

Component location diagrams showing test points and variable components are contained in the diagrams section (section VI).

5.5.1 MKR-350 Test and Alignment Procedures

Note

Unless otherwise specified, the standard input signal is a 75-MHz signal, amplitude modulated 95 percent at 1300 Hz. The rf input level is 2000 μV fed through a 6-dB pad from a 50-ohm source.

5.5.1.1 Preliminary Checks

5.5.1.1.1 Power Supply

a. Position the HIGH/LOW/TEST control to LOW. Apply +13.75 V dc to P1 pin 10, ground pins 5 and 11. Observe current drain. Result: Less than 167 mA.
b. Connect dvm to test point TP7 and observe indication. Result: 7.8 to 9.0 V dc.

5.5.1.1.2 Lamp Test

Set and hold HIGH/LOW/TEST control in TEST position. Result: All three marker lamps (O, M, and I) are fully illuminated.

5.5.1.2 Initial Adjustments

Note

Depending upon the type and size of aircraft, flight procedures, and applications, marker receiver operation may appear to be too sensitive in some cases. This situation is especially noticeable in aircraft that include exceptionally sensitive marker beacon antenna installations.

Although marker sensitivity is initially set by the factory per TSO specifications, the receiver sensitivity may be adjusted by the Collins dealer to suit individual preference. Reducing the receiver sensitivity shortens the duration of audio tone and lamp illumination that effectively provides a more exact indication of beacon passage. As adjusted by the factory, high sensitivity is set for 200 μV at 95-percent modulation, and low sensitivity is set for 1000 μV, also at 95-percent modulation. To change receiver sensitivity, both high and low sensitivity levels should be reduced by adjusting R12 and R13. Reports from the field indicate that levels of 4000 μV for low sensitivity and 1000 μV for high sensitivity are approximately correct in most installations. These levels are, however, approximations and are subject to change per pilot preference. To adjust receiver sensitivity, follow the high and low sensitivity adjustment procedures contained in paragraphs 5.5.1.2.4 and 5.5.1.2.5 in this section, and adjust the rf input signal as required to arrive at the desired sensitivity level.

Occasionally slight background noise generated by other airborne equipment may be observed in marker audio at factory sensitivity settings. This interference may be eliminated by reducing receiver sensitivity as described in the preceding discussion, or by using triax cable or double-shielded coax between the receiver and the antenna when no change in sensitivity is desired.

5.5.1.2.1 Oscillator

a. Set the HIGH/LOW TEST switch to HIGH and adjust high sensitivity potentiometer R13 for maximum wiper voltage (wiper of R13 will be pointing toward potentiometer R12).

Note

If the receiver section is known to be operating properly, the receiver audio output can be used as an indicator of oscillator startup. If this process is used (rather than the scope method of step b) connect headphones to the audio output terminals and apply a 2000-μV, 75-MHz rf signal modulated 95 percent with 1300 Hz to the antenna input terminal.

b. Position the probe of an oscilloscope with usable response at 85 MHz near the oscillator circuit. Do not connect the probe to oscillator or mixer circuits — simply hold the probe close to the oscillator.
c. While observing the scope (or listening for audio), rotate L5 in a counterclockwise direction until the oscillator stops. Slowly rotate L5 clockwise until startup is observed and note slug position. Rotate L5 clockwise until oscillator stops, then rotate the slug counterclockwise until oscillator just starts. Note position of slug, then position the slug halfway between the two startup points. If the oscillator does not stop with the slug against the circuit board, position the slug halfway between the board and the outer startup position.

Note

When adjusting the slug of L5, attach a piece of tape to the slug adjustment tool, forming the tape into a small flag. This flag will amplify tool position change (rotation) and make adjustment easier and more accurate.

d. Apply a 200-μV, 75-MHz rf signal modulated 95 percent with 1300 Hz to the antenna terminal. Adjust R13 so that the amber lamp (M) is extinguished, then rotate R13 until lamp just turns on. Ensure HIGH/LOW/TEST switch is in the HIGH position during adjustment.

Note

If the receiver was adjusted to a sensitivity other than 200 μV before repair, reset to original sensitivity prior to installation in the aircraft.

5.5.1.2.2 AGC

a. Set the HIGH/LOW/TEST switch to HIGH. Set the wiper of high sensitivity potentiometer R13 to mid-range.
b. Apply a 10 000-μV, 75-MHz signal, modulated 95 percent with 1300 Hz to the antenna terminal.
c. Adjust AGC potentiometer R26 to produce a 1.3-V p-p signal at TP3.

5.5.1.2.3 Receiver Alignment

a. Apply an rf input signal at 0 μV modulated 95 percent with 1300 Hz. Connect dvm to AGC test point TP2 and ground. Position HIGH/LOW/TEST control to HIGH.
b. Increase the rf input level until an increase of 0.1 volt is observed on dvm.
c. Adjust L1, L2, L3, L4, and L6, in that order, to provide maximum AGC voltage while simultaneously reducing generator rf level to maintain the 0.1-volt increase over the static AGC level.
d. Repeak all coils after initial adjustments have been made.

5.5.1.2.4 HIGH Sensitivity Adjustment

a. Apply an rf input signal at 200 μV modulated 95 percent with 1300 Hz. Set the HIGH/LOW/TEST control to HIGH.
b. Observe amber (M) lamp, and adjust R13 until the lamp just comes on.

5.5.1.2.5 LOW Sensitivity Adjustment

a. Apply an rf input signal at 1000 μV modulated 95 percent with 1300 Hz. Set the HIGH/LOW/TEST control to LOW.
b. Observe amber (M) lamp, and adjust R12 until the lamp just comes on.

5.5.1.2.6 Audio Output

a. Apply an rf input signal at 2 mV modulated 95 percent with 1300 Hz. Position the HIGH/LOW/TEST control to HIGH. Connect audio power meter to P1 pin 6 and ground.
b. Adjust R45 to provide 1.65 ±0.05 V rms output into a 500-ohm load.

5.5.1.3 Test Procedures

5.5.1.3.1 Power Supply

a. Position the HIGH/LOW/TEST control to LOW. Apply +13.75 V dc to P1 pin 10, ground pins 5 and 11. Observe current drain. Result: Less than 167 mA.
b. Connect dvm to test point TP7 and observe indication. Result: 8.0 to 8.5 V dc.

5.5.1.3.2 Lamp Check (without SB 4)

a. Set rf input level to 10 mV and modulate 95 percent at 3000 Hz. Set HIGH/LOW/TEST control to LOW.
b. Connect dvm to P1 pin 7 and ground and observe indication. Results: 4.0 to 6.0 V dc; white (I) lamp illuminated.
c. Cover photocell with soft opaque cloth and observe dvm indication. Results: 1.0 to 3.0 V dc; white (I) lamp becomes dimmer.
d. Remove opaque cloth from photocell. Modulate rf input signal with 1300 Hz. Connect dvm to P1 pin 9 and ground and observe indication. Results: 4.0 to 6.0 V dc; amber (M) lamp illuminated.
e. Cover photocell with opaque cloth and observe dvm indication. Results: 1.0 to 3.0 V dc; amber (M) lamp becomes dimmer.
f. Remove opaque cloth from photocell. Modulate rf input signal with 400 Hz. Connect dvm to P1 pin 8 and ground and observe indication. Results: 4.0 to 6.0 V dc; blue (O) lamp is illuminated.
g. Cover photocell with opaque cloth and observe dvm indication. Results: 1.0 to 3.0 V dc; blue (O) lamp becomes dimmer.

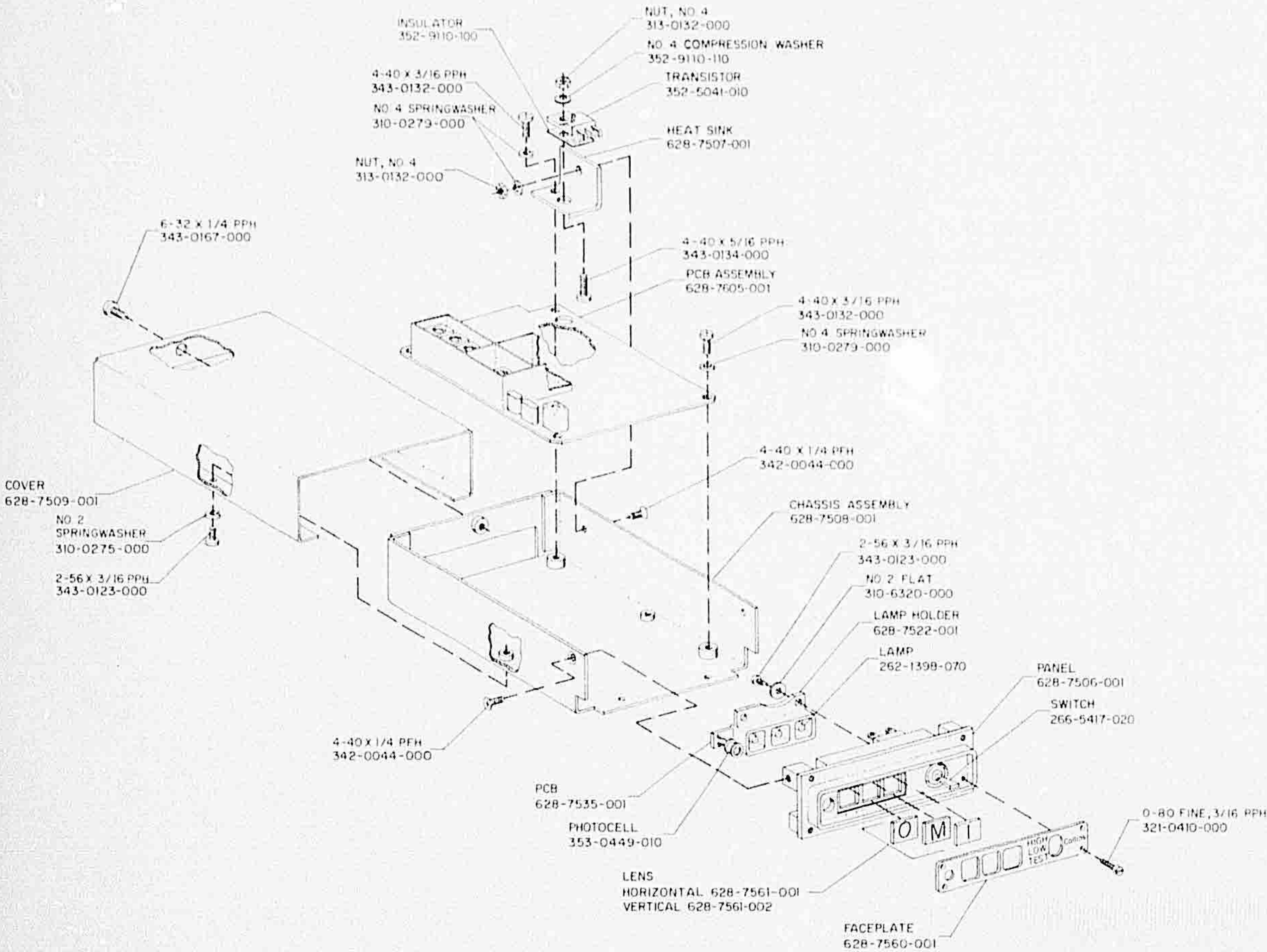
5.5.1.3.2A Lamp Check (with SB 4)

a. Set rf input level to 10 mV and modulate 95 percent at 3000 Hz. Set HIGH/LOW/TEST control to LOW.
b. Connect dvm to P1 pin 7 and ground and observe indication. Results: 4.0 to 6.0 V dc; white (I) lamp illuminated.
c. Cover photocell with soft opaque cloth and observe dvm indication. Results: not less than 2.0 V dc; white (I) lamp becomes dimmer.

d. Remove opaque cloth from photocell. Modulate rf input signal with 1300 Hz. Connect dvm to P1 pin 9 and ground and observe indication. Results: 4.0 to 6.0 V dc; amber (M) lamp illuminated.
e. Cover photocell with opaque cloth and observe dvm indication. Results: not less than 2.0 V dc; amber (M) lamp becomes dimmer.
f. Remove opaque cloth from photocell. Modulate rf input signal with 400 Hz. Connect dvm to P1 pin 8 and ground and observe indication. Results: 4.0 to 6.0 V dc; blue (0) lamp illuminated.
g. Cover photocell with opaque cloth and observe dvm indication. Results: not less than 2.0 V dc; blue (0) lamp becomes dimmer.
h. Connect dvm to P1 pin 9. Remove opaque cloth and observe indication. Results: not more than 0.5 V dc with photocell in bright ambient light.

5.5.1.3.3 Audio Frequency Response

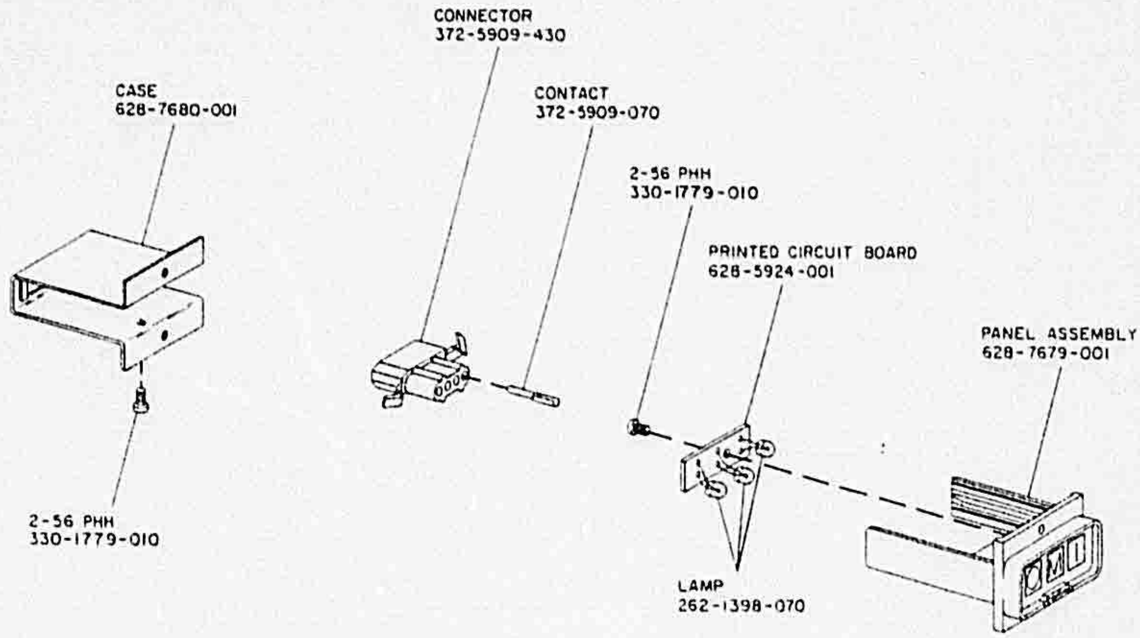
a. Position the HIGH/LOW/TEST control to LOW. Apply an rf input signal at 10 mV modulated 95 percent with 380 Hz.
b. Connect audio power meter to P1 pin 6 and ground and record result.
c. Repeat step b for each of the following modulation frequencies: 400, 420, 1235, 1300, 1365, 2850, 3000, and 3150 Hz.
d. Compare dB variation between modulating frequencies. Result: Not more than 6-dB variation.

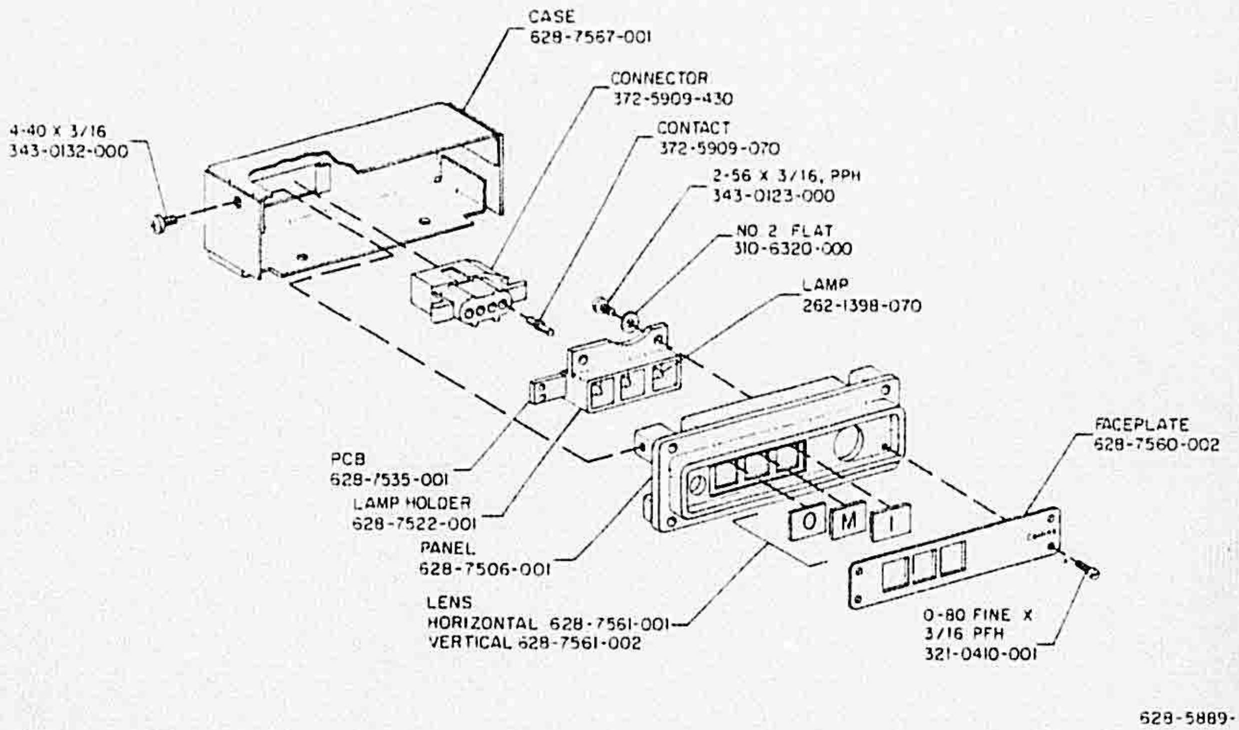


628-5987-

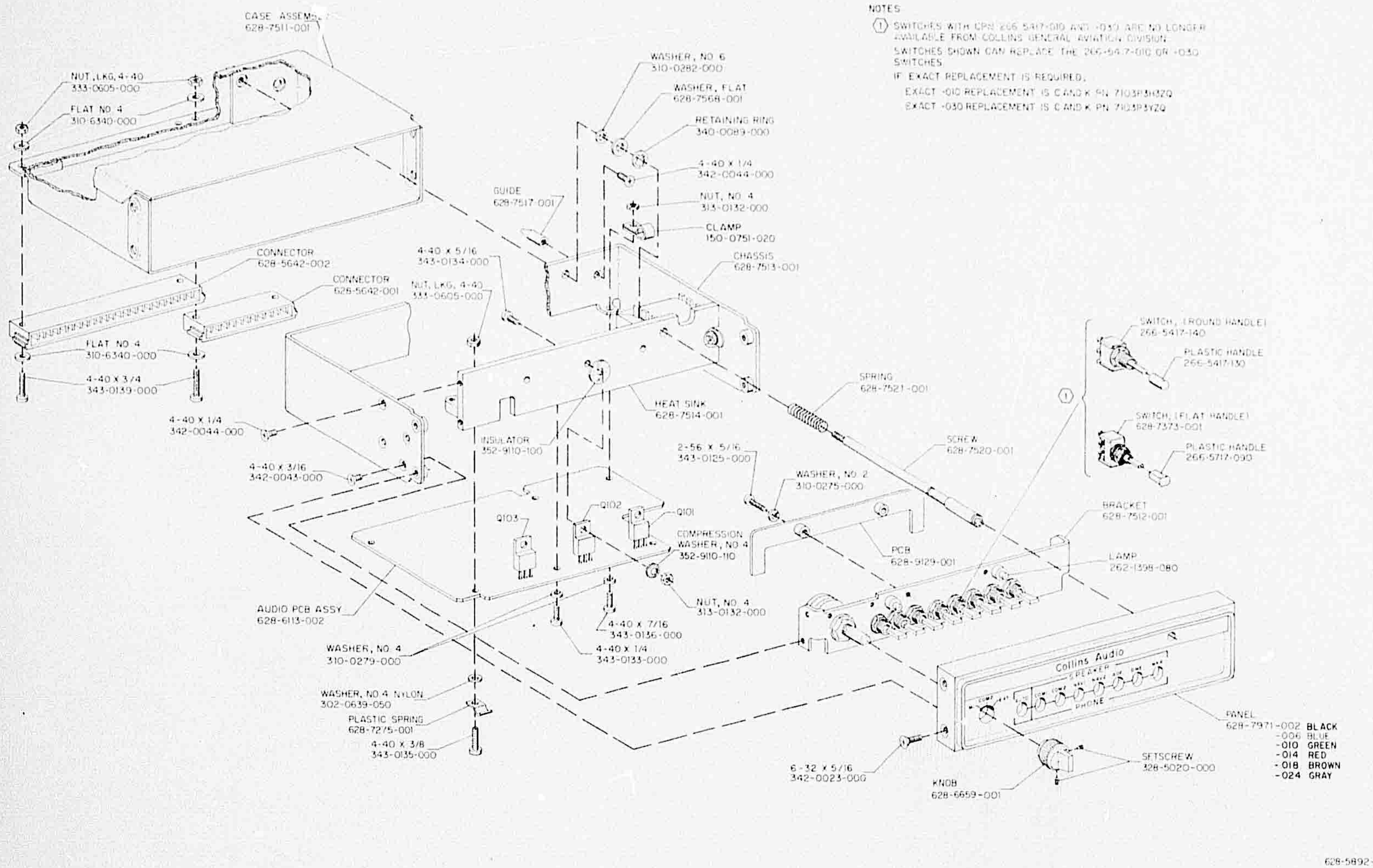
MKR-350 Marker Receiver, Exploded View
Figure 5-1

 Revised 9 June 1982

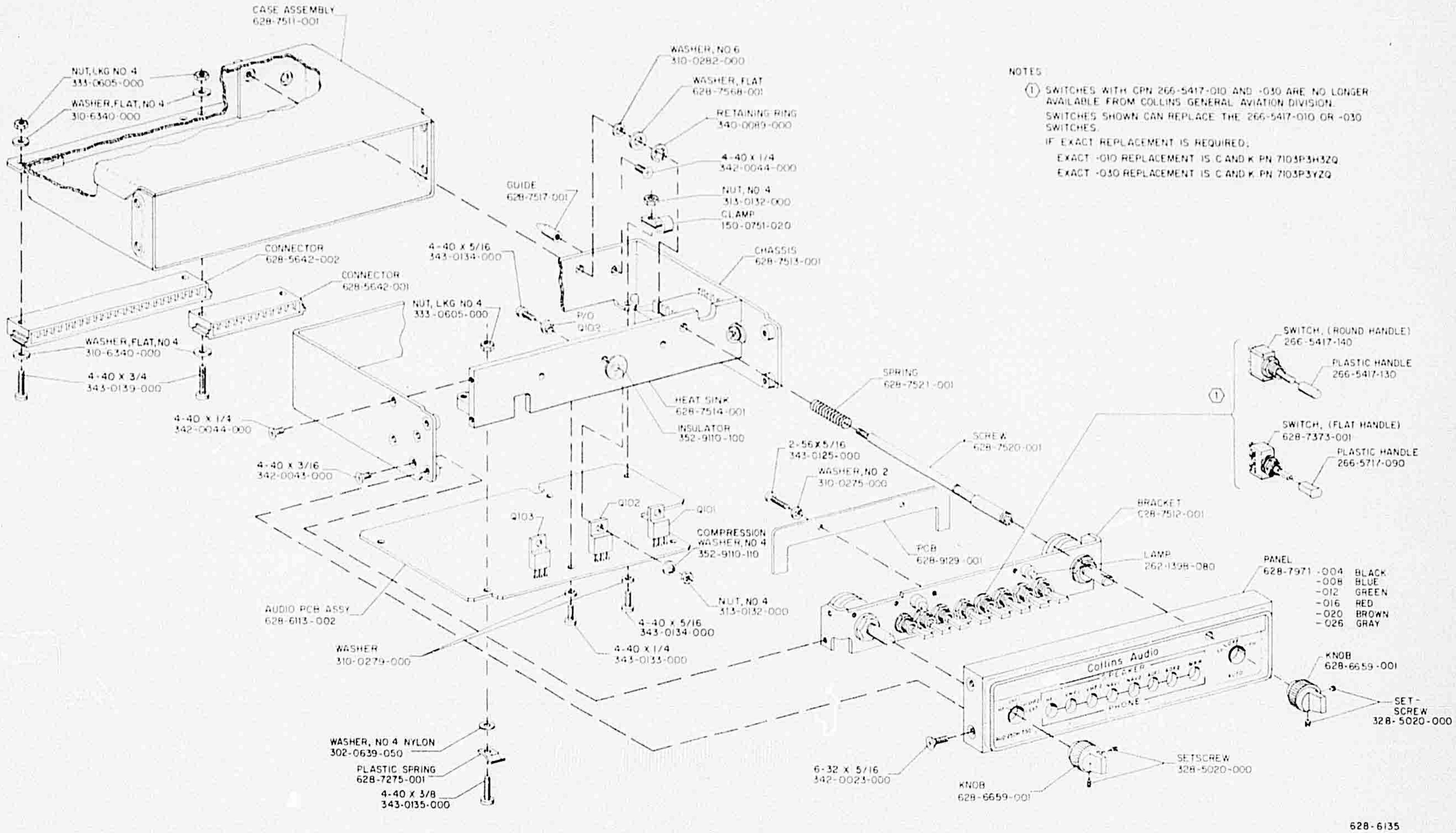




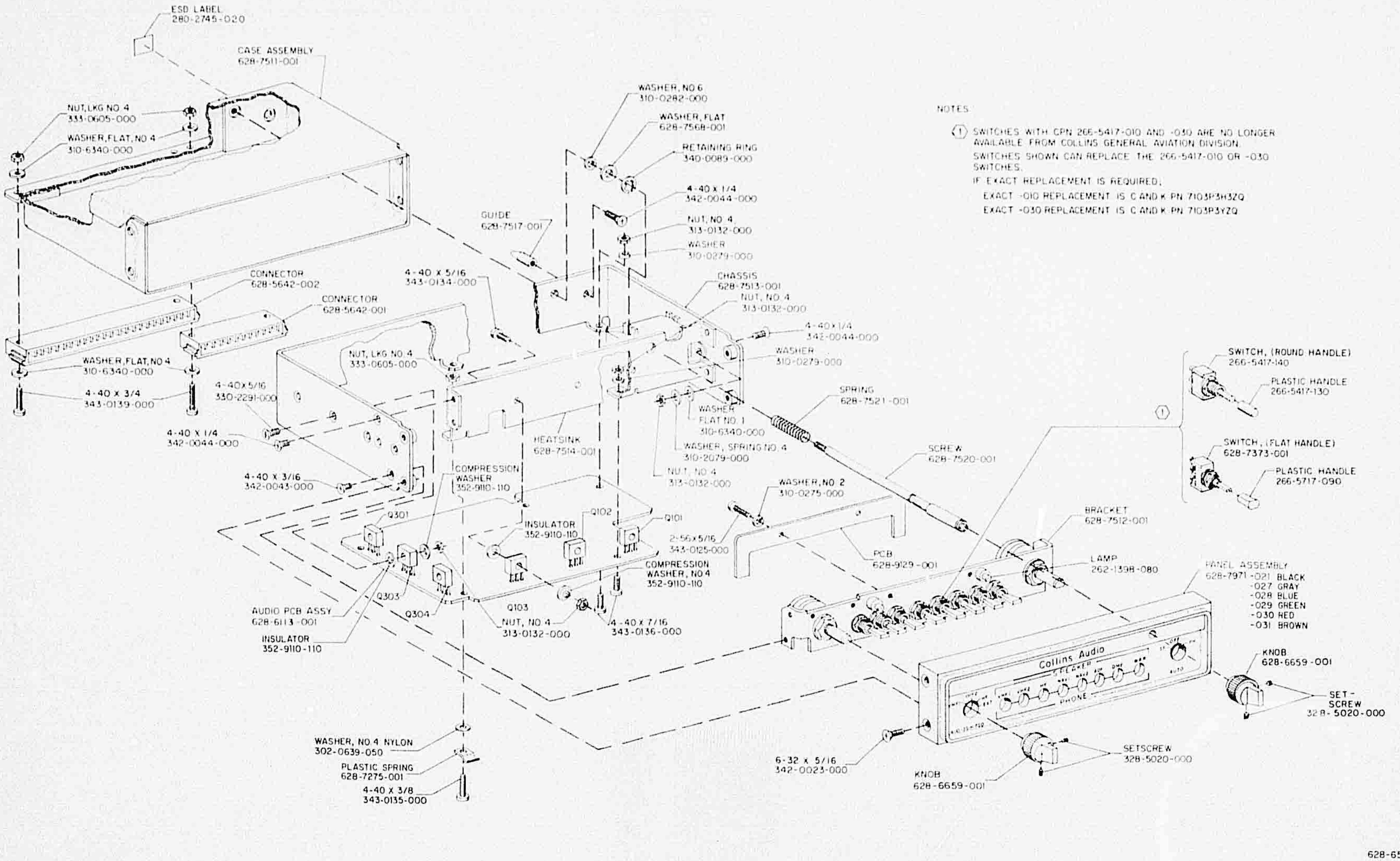
MKL-350/351 Remote Marker Lights, Exploded View
Figure 5-2



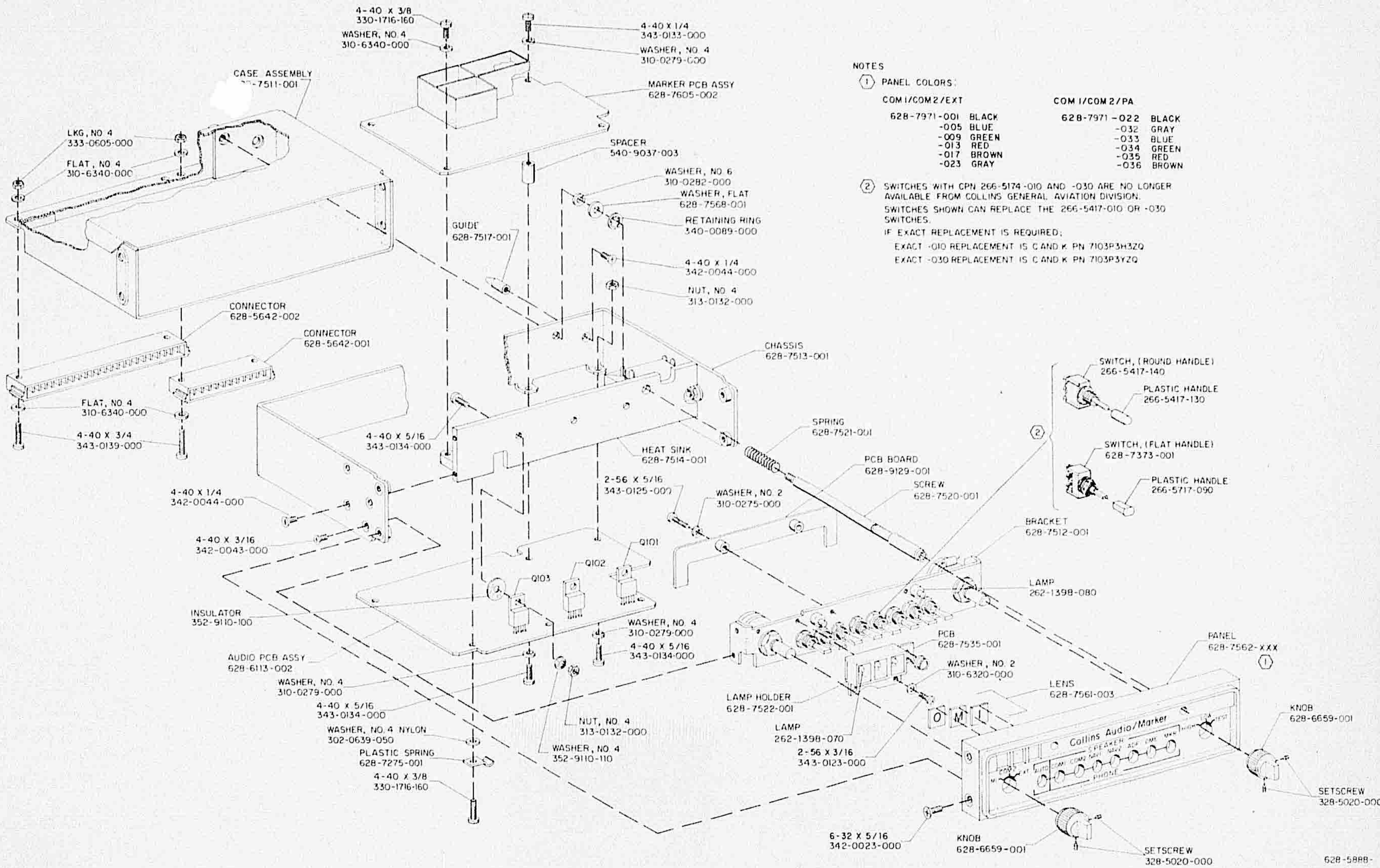
AUD-250 Audio Panel, Exploded View
Figure 5-3



AUD-250H Audio Panel, Exploded View
Figure 5-4



AUD-251H Audio Panel, Exploded View
Figure 5-5



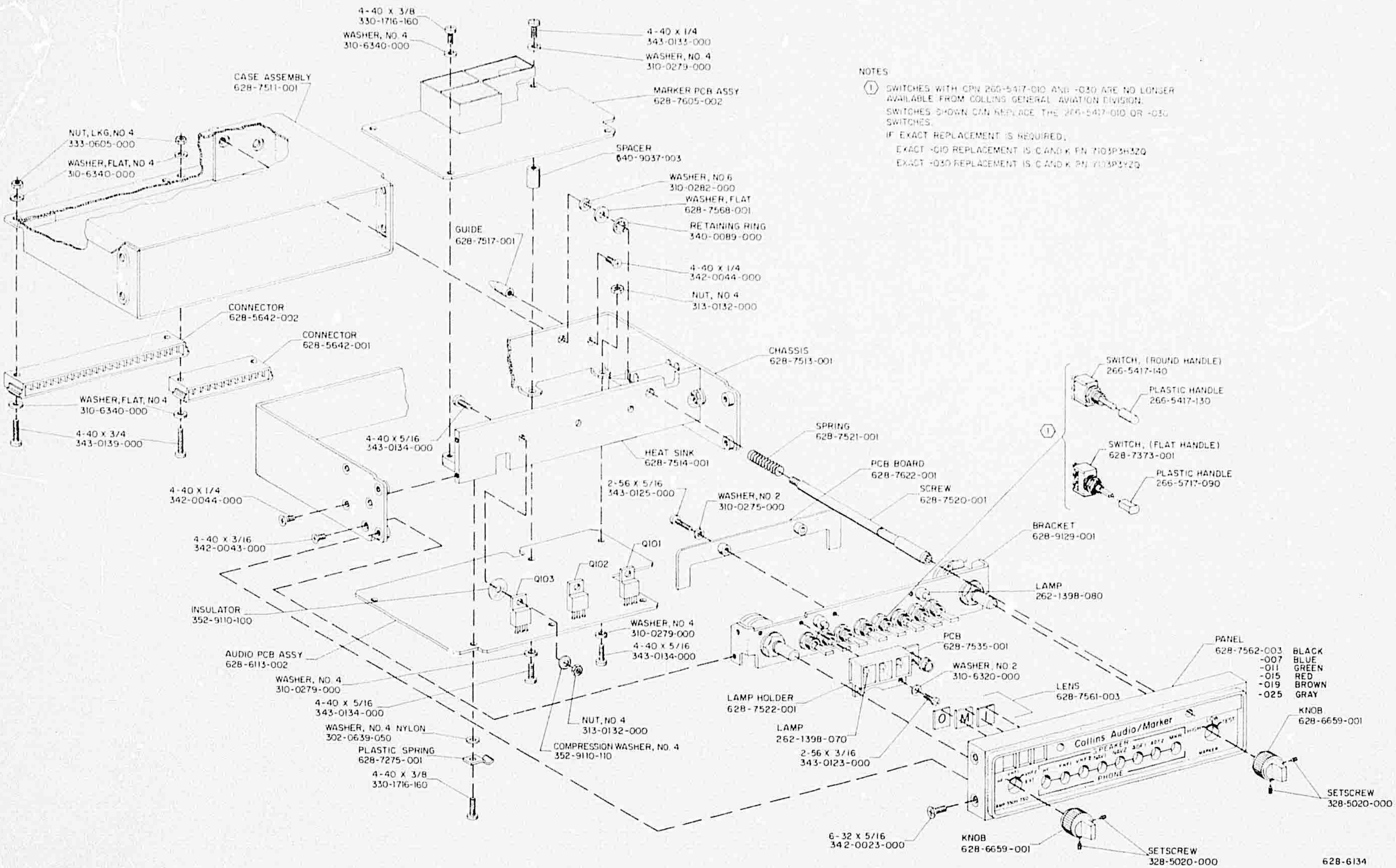
NOTES

1. PANEL COLORS:

COM 1/COM 2/EXT		COM 1/COM 2/PA	
628-7971-001	BLACK	628-7971-022	BLACK
-005	BLUE	-032	GRAY
-009	GREEN	-033	BLUE
-013	RED	-034	GREEN
-017	BROWN	-035	RED
-023	GRAY	-036	BROWN

2. SWITCHES WITH CPN 266-5174-010 AND -030 ARE NO LONGER AVAILABLE FROM COLLINS GENERAL AVIATION DIVISION.
SWITCHES SHOWN CAN REPLACE THE 266-5417-010 OR -030 SWITCHES.
IF EXACT REPLACEMENT IS REQUIRED;
EXACT -010 REPLACEMENT IS C AND K PN 7103P3H3ZQ
EXACT -030 REPLACEMENT IS C AND K PN 7103P3YZQ

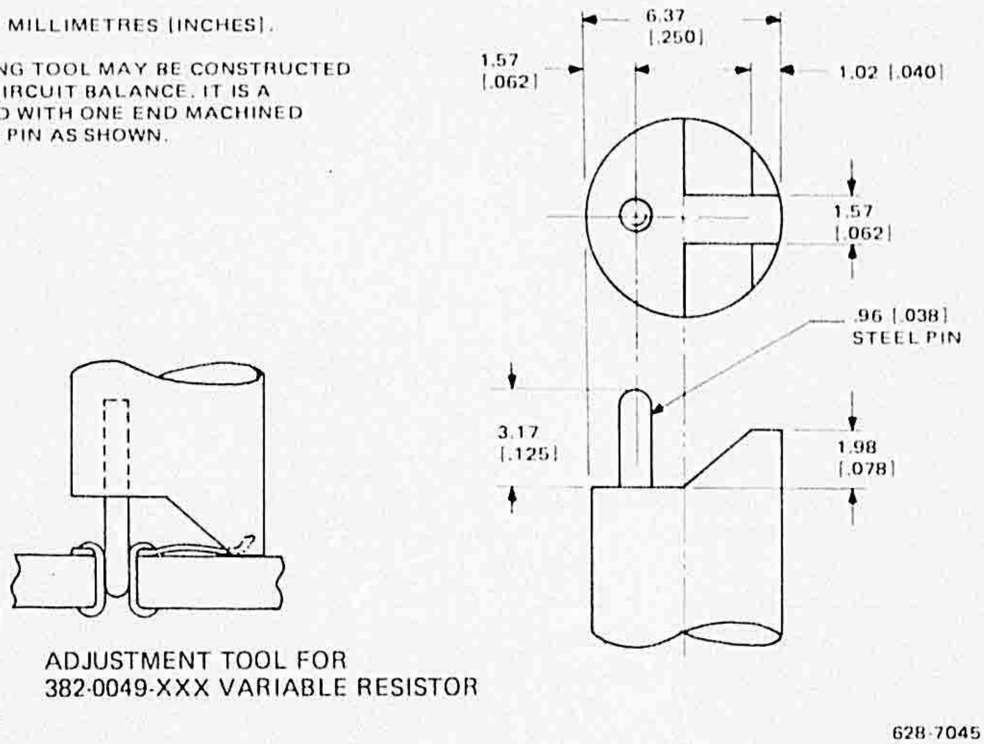
AMR-350 Audio/Marker Panel, Exploded View
Figure 5-6



AMR-350H Audio/Marker Panel, Exploded View
Figure 5-7

NOTES:
1. DIMENSIONS ARE IN MILLIMETRES [INCHES].

2. A SPECIAL ADJUSTING TOOL MAY BE CONSTRUCTED FOR USE IN FINAL CIRCUIT BALANCE. IT IS A SIMPLE PLASTIC ROD WITH ONE END MACHINED AND FITTED WITH A PIN AS SHOWN.



Adjustment Tool for 382-0049-XXX Variable Resistors
Figure 5-8

5.5.1.3.4 Lamp Frequency Response

a. Position the HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 1000 μV modulated 95 percent with 390 Hz. Result: Blue (O) lamp illuminated.
b. Slowly reduce rf input until the blue (O) lamp just goes out. Record rf input level.
c. Repeat steps a and b for the following modulation frequencies: 400 and 410 Hz.
d. Apply an rf input signal at 1000 μV modulated 95 percent with 1270 Hz. Results: Amber (M) lamp illuminated.
e. Slowly reduce rf input until the amber (M) lamp just goes out. Record rf input level.
f. Repeat steps d and e for the following modulation frequencies: 1300 and 1330 Hz.
g. Apply an rf input signal at 1000 μV modulated 95 percent with 2920 Hz. Results: White (I) lamp illuminated.
h. Slowly reduce rf input level until the white (I) lamp just goes out. Record rf input level.
i. Repeat steps g and h for each of the following modulation frequencies: 3000 and 3080 Hz.
j. After all data has been collected, compare dB variation of readings. Result: Not more than 6-dB variation.

5.5.1.3.5 Automatic Gain Control

a. Position the HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 200 μV modulated 95 percent with 400 Hz.
b. Connect audio power meter to P2 pin 23 and ground and record indication. Blue (O) marker lamp should also be illuminated.
c. Increase the rf input level to 1000 μV, then 10,000 μV, 100,000 μV and 200,000 μV and record audio output level for each.
d. Apply an rf input signal at 200 μV modulated 95 percent with 1300 Hz. Record audio output level and observe amber (M) marker lamp is illuminated. Repeat step C.
e. Apply an rf input signal at 200 μV modulated 95 percent with 3000 Hz. Record audio output level and observe white (I) marker lamp is illuminated. Repeat step C.
f. After all data has been collected, compare dB variation of readings. Result: Not more than 8-dB variation.

5.5.1.3.6 Audio Output Power

a. Position the HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 2 mV modulated 95 percent with 400 Hz.
b. Connect audio voltmeter to P1 pin 6 and ground across a 500-ohm load and observe audio output level. Result: Not less than 1.6 V rms.
c. Repeat steps a and b for modulation frequencies of 1300 and 3000 Hz. Result: Not less than 1.6 V rms output.

5.5.1.3.7 Audio Noise Output

a. Position HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 2 mV modulated 95 percent with 1300 Hz.
b. Connect audio power meter to P1 pin 6 and ground, and record audio output level.
c. Remove rf input signal (disconnect antenna) and observe audio output level. Result: Audio output level is at least 26 dB below level obtained with rf signal applied.

5.5.2 AUD-250/250H Test and Alignment Procedures

5.5.2.1 Preliminary Checks

5.5.2.1.1 Power Supply

a. Apply +13.75 V dc to P101 pin 10, ground pin 11. Turn panel lights off and observe current drain. Result: Less than 312 mA.
b. Connect dvm to junction of resistors R217 and R223 and ground. Observe indication. Result: 7.8 to 9.0 V dc.

5.5.2.1.2 Lamp Check

Turn on panel lamps and confirm that all four lamps are illuminated.

5.5.2.1.3 Audio Switching Check

a. Using an ohmmeter, with power removed, check for proper operation of toggle switches S102 through S109. Checks should be made through unit connector P102.
b. Apply unit power and check for proper microphone selector switch operation by toggling AUTO control between SPEAKER and PHONE for both COM 1 and COM 2 positions of microphone selector switch.
c. Verify that EXT position provides an output at P102 pin 5 when audio is applied to aircraft microphone input pin 7.

5.5.2.2 Initial Adjustments

5.5.2.2.1 External Speaker Audio Level

a. Position microphone selector switch S101 to EXT. Ground P102 pin 8 (AIRCRAFT KEYLINE), and apply an audio input signal at 250 mV rms, 1000 Hz to P102 pin 7 (AIRCRAFT MICROPHONE).
b. Connect ac voltmeter to EXT SPEAKER (8Ω) output P102 pin 5 and AUDIO GND P102 pin 2. Adjust R219 to obtain a reading of 6.3 V rms.

5.5.2.2.2 Speaker Amplifier Bias (Circuit Board 628-6114-XXX Only)

Note

The following procedure should be performed only after components in the final output stage have been replaced.

a. With no signal applied, adjust R228 to set the voltage across R231, and adjust R229 to set the voltage across R230. Adjust R228 and R229 so that the voltages across R231 and R230 are within 1 millivolt of each other and neither voltage exceeds 15 millivolts.
b. Apply a 1000-Hz signal to the amplifier and adjust the input level to produce 50 milliwatts into 3.2 ohms. Measure harmonic distortion plus noise. Result: distortion plus noise does not exceed 4 percent.

5.5.2.3 Test Procedures

5.5.2.3.1 Power Output

a. Position the COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 5-V rms, 350-Hz audio signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4 and AUDIO GND pin 2 and observe indication. Result: Not less than 4 V rms.
c. Repeat steps a and b for audio frequencies of 1000 and 3000 Hz. Result: Not less than 4 V rms for each frequency.

5.5.2.3.2 Frequency Response

a. Position the COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 1000-Hz audio signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4 and AUDIO GND pin 2. Adjust generator audio output level until 4 V rms is observed on meter. This is the 0-dB output reference level.
c. Apply a 350-Hz audio signal, and observe the output indication. Result: Within 3 dB of reference (0 dB).
d. Apply a 3000-Hz audio signal, and observe the output indication. Result: Within 3 dB of reference (0 dB).

5.5.2.3.3 Signal-to-Noise Ratio

a. Position the COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 5-V rms, 3000-Hz input signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4 and AUDIO GND P102 pin 2. Observe and record indication in dB.
c. Remove audio input signal and observe indication. Result: Signal-to-noise ratio not less than 40 dB.

5.5.2.3.4 Muting

a. Set microphone selector switch to COM 1. Position COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 5-V rms, 3000-Hz input signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4, and AUDIO GND P102 pin 2. Record indicated output in dB.
c. Ground AIRCRAFT KEYLINE P102 pin 8, and observe ac voltmeter indication. Result: Not less than 40-dB difference from indication recorded in step b.
d. Remove AIRCRAFT KEYLINE ground. Remove ac voltmeter and connect oscilloscope in its place. Reapply ground to AIRCRAFT KEYLINE P102 pin 8, and observe the fall time of the waveform. Result: Fall time not more the 10 ms.
e. Remove the AIRCRAFT KEYLINE ground and measure waveform rise time. Result: Rise time not more than 100 ms.

5.5.3 AUD-251H Test and Alignment Procedures

5.5.3.1 Preliminary Checks

5.5.3.1.1 Power Supply

a. Apply +13.75 V dc to P101 pins 2 (phones +13.75 V dc) and 10 (speaker +13.75 V dc), ground P101 pin 11 (power ground), and observe current drain. Result: Less than 400 mA.

b. Using a dvm, measure the voltage at Q206 emitter. Result: 7.8 to 9.0 V dc. Measure voltage at Q301 emitter. Result: 10.7 to 12.1 V dc.

5.5.3.1.2 Lamp Check

Apply +13.75 V dc to P101 pin 8 (14-V dimmer), ground pin 11 (power ground), and observe panel lights. Result: All four lamps are illuminated and panel lighting is even.

5.5.3.1.3 Audio Switching Check

a. Connect a 3.2-ohm load to P102 pin 4 (cabin speaker), and a 250-ohm load to P102 pin 15 (headphone); audio ground is P102 pin 2. Apply power to the unit and set all switches to their center positions. Set the AUTO control to OFF. Apply an audio signal to each radio input pin (one at a time), and check for proper phone and speaker output for the corresponding switch, using an audio power meter or ac voltmeter across the load.
b. Set all toggle switches to their center positions and check for speaker and phone outputs when the AUTO control is switched to SP and PH. Repeat for each transceiver input.
c. Connect an 8-ohm load to P102 pins 5 (external speaker) and 2 (audio ground) and select EXT position of S101. Apply an audio signal to P102 pin 7 (transmit microphone) and ground P102 pin 8 (transmit key line). Check for an audio output across the 8-ohm load.
d. Check for proper connections from P102 pin 8 and P102 pin 7 inputs to the transceiver outputs with the selector switch in the VHF 1, VHF 2, and HF positions. Switched audio should be at the correct input to each transceiver.

5.5.3.2 Test Procedures

Perform the test procedures described in the following paragraphs to determine if the AUD-251H is operationally acceptable. Should the AUD-251H fail to meet any of the performance parameters included in the test results, refer to paragraph 5.5.3.3 for adjustment procedures. After adjustment or component replacement, all test procedures must be repeated.

5.5.3.2.1 Speaker Amplifier Power Output

a. Set selector switch S101 (VHF 1/VHF 2/HF/EXT) to VHF 1 and VHF 1 toggle switch to the SPEAKER position. Set all other toggle switches to their center positions.
b. Apply a 5.0-V rms audio signal at 1000 Hz to P102 pin 17 (VHF 1 audio). Load the speaker amplifier with 3.2 ohms (connect across P102 pins 4 and 2), and observe audio output level using an ac voltmeter or audio power meter. Result: Not less than 5 watts (4.0 V rms).

5.5.3.2.2 Speaker Amplifier Frequency Response

a. Set selector switch S101 to VHF 1 and toggle switch VHF 1 to the SPEAKER position. Set all other toggle switches to their center positions.
b. Place a 3.2-ohm load and ac voltmeter across the audio output, P102 pins 4 and 2, and apply an audio signal at 1000 Hz to P102 pin 17. Adjust the audio input level to produce a 1-watt (1.79-V rms) output.
c. Holding the input level constant, measure the output at 350 and 3000 Hz. Result: Output must be between 0.5 and 1.5 watts (1.26 to 2.19 V rms).

5.5.3.2.3 Speaker Amplifier Noise Level

a. Set selector switch S101 to VHF 1 and all toggle switches to their center positions.
b. Place a 3.2-ohm load and ac voltmeter across P102 pins 4 and 2. Measure output voltage. Result: Not greater than 4 mV.

5.5.3.2.4 Speaker Amplifier Muting

a. Set selector switch S101 to VHF 1 and toggle switch VHF 1 to the SPEAKER position. Set all other toggle switches to their center positions.
b. Place a 3.2-ohm load across P102 pins 4 and 2 and apply a 5-V rms audio signal at 3000 Hz to P102 pin 17. Connect an ac voltmeter across audio load and measure the output in dB. Record this measurement for reference.
c. Ground P102 pin 8 (transmit key line) and observe meter indication. Result: Not less 40 dB below indication recorded in step b. Remove ground from P102-8.
d. Remove ac voltmeter from load and connect oscilloscope in its place. Reapply ground to P102-8 and observe fall time of waveform. Result: Fall time not more than 10 ms.
e. Remove ground from P102-8 and observe waveform rise time. Result: Rise time not more than 100 ms.

5.5.3.2.5 Headphone Amplifier Output Capability

Note

The following results will be obtained only when the AUD-251H has been adjusted for standard gain as preset by the factory. Standard gain is defined as a 5 V rms 1000 Hz audio signal input yielding an 8 V rms output across a 250 ohm load. (622-3101-021 output is 5 V rms across a 250-ohm load.)

a. Set selector switch S101 to VHF 1 and toggle switch VHF 1 to PHONE. Set all other toggle switches to their center positions.
b. Connect a 250-ohm load and ac voltmeter across P102 pins 15 (headphone) and 2 (audio ground).
c. Apply a 5-V rms audio signal at 1000 Hz to P102 pin 17 (VHF 1 audio) and observe output level. Result: 7.5 to 8.5 V rms. (622-3101-021 result: 4.8 to 5.2 V rms.)

5.5.3.2.6 Headphone Amplifier Frequency Response

Note

The following results will be obtained only when the AUD-251H has been adjusted for standard gain as preset by the factory. Standard gain is defined as a 5 V rms 1000 Hz audio signal input yielding an 8 V rms output across a 250 ohm load. (622-3101-021 output is 5 V rms across a 250-ohm load.)

a. Set selector switch S101 to VHF 1 and toggle switch VHF 1 to the PHONE position. Set all other toggle switches to their center positions.
b. Connect a 250-ohm load and ac voltmeter across P102 pins 15 and 2, and apply an audio signal at 1000 Hz to P102 pin 17. Adjust the generator input level until a 2-V rms output is achieved.
c. Holding the generator output level constant, measure the output at 350 and 3000 Hz. Result: 1.4 to 2.3 V rms.

5.5.3.2.7 Headphone Amplifier Noise Level

Note

The following results will be obtained only when the AUD-251H has been adjusted for standard gain as preset by the factory. Standard gain is defined as a 5 V rms 1000 Hz audio signal input yielding an 8 V rms output across a 250 ohm load. (622-3101-021 output is 5 V rms across a 250-ohm load.)

a. Set selector switch S101 to VHF 1 and all toggle switches to their center positions.
b. Connect a 250-ohm load and ac voltmeter across P102 pins 15 and 2. Observe meter indication. Result: Not more than 8 mV.

5.5.3.2.8 Headphone Amplifier Muting and Sidetone Selection

Note

The following results will be obtained only when the AUD-251H has been adjusted for standard gain as preset by the factory. Standard gain is defined as a 5 V rms 1000 Hz audio signal input yielding an 8 V rms output across a 250 ohm load. (622-3101-021 output is 5 V rms across a 250-ohm load.)

a. Set selector switch S101 to VHF 2 and toggle switch VHF 1 to PHONE. Set all other toggle switches to their center positions.
b. Connect a 250-ohm load and ac voltmeter across P102 pins 15 and 2, and apply a 5-V rms audio signal at 1000 Hz to P102 pin 17. Measure the output in dB and record.
c. Ground P102 pin 8 and observe the output. Result: Audio output decreases by at least 40 dB.
d. With P102 pin 8 still grounded, apply the 5-V rms, 1000-Hz audio signal to P102 pin 18 (VHF 2 audio) and observe audio output. Result: Audio output between 3 and 5 V rms. (622-3101-021 output between 1.8 and 3.2 V rms.)

5.5.3.2.9 Headphone Amplifier Intercom Gain

Note

The following results will be obtained only when the AUD-251H has been adjusted for standard gain as preset by the factory. Standard gain is defined as a 5 V rms 1000 Hz audio signal input yielding an 8 V rms output across a 250 ohm load. (622-3101-021 output is 5 V rms across a 250-ohm load.)

a. Set selector switch S101 to VHF 1 and all toggle switches to their center positions.
b. Connect a 250-ohm load and an ac voltmeter across P102 pins 15 and 2, and apply a 150-mV rms audio signal at 1000 Hz to each of the five ICS microphone inputs (P101-3, -4, -5, -6 and P102-6) one at a time. Observe ac voltmeter for each input. Result: Audio output is 1.0 to 1.4 V rms. (622-3101-021 result: 0.55 to 0.95 V rms audio output.)
c. With the audio signal applied to P102 pin 6 (ICS mic 5), ground P102 pin 8 (transmit key line) and observe ac voltmeter. Result: Audio output decreases at least 40 dB.

5.5.3.3 Adjustments

Potentiometers R228, R229, and R326 should not be adjusted as part of a routine setup. These controls should be adjusted only after a component failure occurs in the final stage of either speaker or headphone amplifiers.

5.5.3.3.1 Initial Adjustments

Preset bias adjustment potentiometers R228, R229, and R326 to their maximum resistance positions.

5.5.3.3.2 Speaker Amplifier Bias

Note

Potentiometers R228 and R229 interact with each other. Proper setup requires alternating adjustment to reach the desired results. Repeat as necessary.

With no audio signal input and a 3.2-ohm load connected across P102 pins 4 and 2, adjust R228 and R229 to produce 15 to 22 mV dc (with respect to ground) at the emitters of Q204 and Q205.

5.5.3.3.3 Headphone Amplifier Bias

With no audio signal input and a 250-ohm load connected across P102 pins 15 and 2, adjust R326 to produce 20 mV dc between the emitter of Q303 and the emitter of Q304.

5.5.4 AMR-350/350H Test and Alignment Procedures

5.5.4.1 Preliminary Checks

5.5.4.1.1 Power Supply

a. Apply +13.75 V dc to P101 pin 10, ground pin 11. Turn panel lights off and observe current drain. Result: Less than 385 mA.
b. Connect dvm to the junction of resistors R217 and R223 and ground. Observe indication. Result: 7.8 to 9.0 V dc.

5.5.4.1.2 Marker Lamp Check

Set and hold HIGH/LOW/TEST control in TEST position. Result: All three marker lamps (O, M, and I) are fully illuminated.

5.5.4.1.3 Lamp Check

Turn on panel lamps and confirm that all lamps are illuminated.

5.5.4.1.4 Audio Switching Check

a. Using an ohmmeter, with power removed, check for proper operation of toggle switches S102 through S109. Checks should be made through unit connector P102.
b. (AMR-350 only)

   Apply unit power and check for proper microphone selector switch operation by toggling AUTO control between SPEAKER and PHONE for COM1 and COM2 positions of microphone selector switch.

c. (AMR-350H only)

   Check for proper connections from P102-7 and P102-8 inputs to the transceiver outputs with the selector switch in the HF, VHF1 and VHF2 positions. Switched audio should be at the correct input to each transceiver.

MICROPHONE SELECTOR SWITCH POSITION	AIRCRAFT KEYLINE (P102-8) CONNECTS TO	AIRCRAFT MICROPHONE (P102-7) CONNECTS TO
HF	HF KEYLINE (P102-10)	HF MICROPHONE (P102-9)
VHF1	VHF-1 KEYLINE (P102-12)	VHF-1 MICROPHONE (P102-11)
VHF2	VHF-2 KEYLINE (P102-14)	VHF-2 MICROPHONE (P102-13)

Note

Key-line outputs have series diodes that can cause some ohmmeters to read incorrectly. Test the ohmmeter with a known good diode and note the diode orientation giving the lowest reading. Connect the test probe connected to the diode's cathode to P101-8. This will forward bias the internal diodes and provide correct continuity readings.

d. Verify that EXT position provides an output at P102 pin 5 when audio is applied to the aircraft microphone input pin 7.

5.5.4.2 Initial Adjustments

Note

Depending upon the type and size of aircraft, flight procedures, and applications, marker receiver operation may appear to be too sensitive in some cases. This situation is especially noticeable in aircraft that include exceptionally sensitive marker beacon antenna installations.

Although marker sensitivity is initially set by the factory per TSO specifications, the receiver sensitivity may be adjusted by the

Collins dealer to suit individual preference. Reducing the receiver sensitivity shortens the duration of audio tone and lamp illumination that effectively provides a more exact indication of beacon passage. As adjusted by the factory, high sensitivity is set for 200 μV at 95-percent modulation, and low sensitivity is set for 1000 μV, also at 95-percent modulation. To change receiver sensitivity, both high and low sensitivity levels should be reduced by adjusting R12 and R13. Reports from the field indicate that levels of 4000 μV for low sensitivity and 1000 μV for high sensitivity are approximately correct in most installations. These levels are, however, approximations and are subject to change per pilot preference. To adjust receiver sensitivity, follow the high and low sensitivity adjustment procedures contained in paragraphs 5.5.4.2.4 and 5.5.4.2.5 in this section, and adjust the rf input signal as required to arrive at the desired sensitivity level.

Occasionally slight background noise generated by other airborne equipment may be observed in marker audio at factory sensitivity settings. This interference may be eliminated by reducing receiver sensitivity as described in the preceding discussion, or by using triax cable or double-shielded coax between the receiver and the antenna when no change in sensitivity is desired.

5.5.4.2.1 Oscillator

a. Set the HIGH/LOW/TEST switch to HIGH and adjust high sensitivity potentiometer R13 for maximum wiper voltage (wiper of R13 will be pointing toward potentiometer R12).

Note

If the receiver section is known to be operating properly, the receiver audio output can be used as an indicator of oscillator startup. If this process is used (rather than the scope method of step b) connect headphones to the audio output terminals and apply a 2000-μV, 75-MHz rf signal modulated 95 percent with 1300 Hz to the antenna input terminal.

b. Position the probe of an oscilloscope with usable response at 85 MHz near the oscillator circuit. Do not connect the probe to oscillator or mixer circuits — simply hold the probe close to the oscillator.

c. While observing the scope (or listening for audio), rotate L5 in a counterclockwise direction until the oscillator stops. Slowly rotate L5 clockwise until startup is observed and note slug postion. Rotate L5 clockwise until oscillator stops, then rotate the slug counterclockwise until oscillator just starts. Note position of slug, then position the slug halfway between the two startup points. If the oscillator does not stop with the slug against the circuit board, position the slug halfway between the board and the outer startup position.

Note

When adjusting the slug of L5, attach a piece of tape to the slug adjustment tool, forming the tape into a small flag. This flag will amplify tool position change (rotation) and make adjustment easier and more accurate.

d. Apply a 200-μV, 75-MHz rf signal modulated 95 percent with 1300 Hz to the antenna terminal. Adjust R13 so that the amber lamp (M) is extinguished, then rotate R13 until lamp just turns on. Ensure HIGH/LOW/TEST switch is in the HIGH position during adjustment.

Note

If the receiver was adjusted to a sensitivity other than 200 μV before repair, reset to original sensitivity prior to installation in the aircraft.

5.5.1.2.2 AGC

a. Set the HIGH/LOW/TEST switch to HIGH. Set the wiper of high sensitivity potentiometer R13 to mid-range.

b. Apply a 10 000-μV, 75-MHz signal, modulated 95 percent with 1300 Hz to the antenna terminal.

c. Adjust AGC potentiometer R26 to produce a 1.3-V p-p signal at TP3.

5.5.1.2.3 Receiver Alignment

a. Apply an rf input signal at 0 μV modulated 95 percent with 1300 Hz. Connect dvm to AGC test point TP2 and ground. Position HIGH/LOW/TEST control to HIGH.

b. Increase the rf input level until an increase of 0.1 volt is observed on dvm.

c. Adjust L1, L2, L3, L4, and L6, in that order, to provide maximum AGC voltage while simultaneously reducing generator rf level to maintain the 0.1-volt increase over the static AGC level.

d. Repeak all coils after initial adjustments have been made.

5.5.1.2.4 HIGH Sensitivity Adjustment

a. Apply an rf input signal at 200 μV modulated 95 percent with 1300 Hz. Set the HIGH/LOW/TEST control to HIGH.

b. Observe amber (M) lamp, and adjust R13 until the lamp just comes on.

5.5.1.2.5 LOW Sensitivity Adjustment

a. Apply an rf input signal at 1000 μV modulated 95 percent with 1300 Hz. Set the HIGH/LOW/TEST control to LOW.

b. Observe amber (M) lamp, and adjust R12 until the lamp just comes on.

5.5.1.2.6 Audio Output

a. Apply an rf input signal at 2 mV modulated 95 percent with 1300 Hz. Position the HIGH/LOW/TEST control to HIGH. Connect audio power meter to P102 pin 23 and ground.

b. Adjust R45 to provide 1.65 ±0.05 V rms output into a 500-ohm load.

5.5.1.2.7 Speaker Amplifier Bias (Circuit Board 628-6114-XXX Only)

Note

The following procedure should be performed only after components in the final output stage have been replaced.

a. With no signal applied, adjust R228 to set the voltage across R231, and adjust R229 to set the voltage across R230. Adjust R228 and R229 so that the voltages across R231 and R230 are within 1 millivolt of each other and neither voltage exceeds 15 millivolts.

b. Apply a 1000-Hz signal to the amplifier and adjust the input level to produce 50 milliwatts into 3.2 ohms. Measure harmonic distortion plus noise. Result: distortion plus noise does not exceed 4 percent.

5.5.4.2.8 External Speaker Audio Level

a. Position microphone selector switch S101 to EXT. Ground P102 pin 8 (AIRCRAFT KEYLINE), and apply an audio input signal at 250 mV rms, 1000 Hz to P102 pin 7 (AIRCRAFT MICROPHONE).
b. Connect ac voltmeter to EXT SPEAKER (8Ω) output P102 pin 5 and AUDIO GND P102 pin 2. Adjust R219 to obtain a reading of 6.3 V rms.

5.5.4.3 Test Procedures

5.5.4.3.1 Marker Lamp Test

a. Connect rf generator input to P101 pin 6, and shield to P101 pin 7. Set rf input level to 10 mV and modulate 95 percent at 3000 Hz. Set HIGH/LOW/TEST control to LOW.
b. Connect dvm to P101 pin 5 and ground and observe indication. Results: 4.0 to 6.0 V dc; white (I) lamp illuminated.
c. Cover photocell with soft opaque cloth and observe dvm indication. Results: 1.0 to 3.0 V dc; white (I) lamp becomes dimmer.
d. Remove opaque cloth from photocell. Modulate rf input signal with 1300 Hz. Connect dvm to P101 pin 3 and ground and observe indication. Results: 4.0 to 6.0 V dc; amber (M) lamp illuminated.
e. Cover photocell with opaque cloth and observe dvm indication. Results: 1.0 to 3.0 V dc, amber (M) lamp becomes dimmer.
f. Remove opaque cloth from photocell. Modulate rf input signal with 400 Hz. Connect dvm to P101 pin 4 and ground and observe indication. Results: 4.0 to 6.0 V dc, blue (O) lamp is illuminated.
g. Cover photocell with opaque cloth and observe dvm indication. Results: 1.0 to 3.0 V dc; blue (O) lamp becomes dimmer.

5.5.4.3.1A Marker Lamp Test (with AMR-350 SB 6, AMR-350H SB 7)

a. Set rf input level to 10 mV and modulate 95 percent at 3000 Hz. Set HIGH/LOW/TEST control to LOW.
b. Connect dvm to P101 pin 5 and ground and observe indication. Results: 4.0 to 6.0 V dc; white (I) lamp illuminated.
c. Cover photocell with soft opaque cloth and observe dvm indication. Results: not less than 2.0 V dc; white (I) lamp becomes dimmer.
d. Remove opaque cloth from photocell. Modulate rf input signal with 1300 Hz. Connect dvm to P101 pin 3 and ground and observe indication. Results: 4.0 to 6.0 V dc; amber (M) lamp illuminated.
e. Cover photocell with opaque cloth and observe dvm indication. Results: not less than 2.0 V dc; amber (M) lamp becomes dimmer.
f. Remove opaque cloth from photocell. Modulate rf input signal with 400 Hz. Connect dvm to P101 pin 3 and ground and observe indication. Results: 4.0 to 6.0 V dc; blue (O) lamp illuminated.
g. Cover photocell with opaque cloth and observe dvm indication. Results: not less than 2.0 V dc; blue (O) lamp becomes dimmer.
h. Connect dvm to P101 pin 3. Remove opaque cloth and observe indication. Results: not more than 0.5 V dc with photocell in bright ambient light.

5.5.4.3.2 Audio Frequency Response

a. Position the HIGH/LOW/TEST control to LOW. Apply an rf input signal at 10 mV modulated 95 percent with 380 Hz.
b. Connect audio power meter to P102 pin 23 and ground and record result.
c. Repeat step b for each of the following modulation frequencies: 400, 420, 1235, 1300, 1365, 2850, 3000, and 3150 Hz.
d. Compare dB variation between modulating frequencies. Result: Not more than 6 dB variation.

5.5.4.3.3 Marker Lamp Frequency Response

a. Position the HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 1000 μV modulated 95 percent with 390 Hz. Result: Blue (O) lamp illuminated.
b. Slowly reduce rf input until the blue (O) lamp just goes out. Record rf input level.
c. Repeat steps a and b for the following modulating frequencies: 400 and 410 Hz.
d. Apply an rf input signal at 1000 μV modulated 95 percent with 1270 Hz. Result: Amber (M) lamp illuminated.
e. Slowly reduce rf input until the amber (M) lamp just goes out. Record rf input level.
f. Repeat steps d and e for the following modulation frequencies: 1300 and 1330 Hz.

g. Apply an rf input signal at 1000 μV modulated 95 percent with 2920 Hz. Result: White (I) lamp illuminated.
h. Slowly reduce rf input level until the white (I) lamp just goes out. Record rf input level.
i. Repeat steps g and h for each of the following modulation frequencies: 3000 and 3080 Hz.
j. After all data has been collected, compare dB variation of readings. Result: Not more than 6-dB variation.

5.5.1.3.4 Automatic Gain Control

a. Position the HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 300 μV modulated 95 percent with 400 Hz.
b. Connect audio power meter to P102 pin 23 and ground and record indication. Blue (O) marker lamp should also be illuminated.
c. Increase the rf input level to 1000 μV, then 10,000 μV, 100,000 μV and 200,000 μV and record audio output level for each.
d. Apply an rf input signal at 300 μV modulated 95 percent with 1300 Hz. Record audio output level and observe amber (M) marker lamp is illuminated. Repeat step c.
e. Apply an rf input signal at 300 μV modulated 95 percent with 3000 Hz. Record audio output level and observe that white (I) marker lamp is illuminated. Repeat step c.
f. After all data has been collected, compare dB variation of readings. Result: Not more than 8-dB variation.

5.5.1.3.5 Marker Audio Output Power

a. Position the HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 2 mV modulated 95 percent with 400 Hz.
b. Connect audio power meter to P102 pin 23 and ground across a 500-ohm load and observe audio output level. Result: Not less than 1.6 V rms.
c. Repeat steps a and b for modulating frequencies of 1300 and 3000 Hz. Result: Not less than 1.6 V rms output.

5.5.1.3.6 Audio Noise Output

a. Position HIGH/LOW/TEST control to HIGH. Apply an rf input signal at 2 mV modulated 95 percent with 1300 Hz.
b. Connect audio power meter to P102 pin 23 and ground and record audio output level.
c. Remove rf input signal (disconnect marker antenna) and observe audio output level. Result: Audio output level is at least 26 dB below level obtained with rf signal applied.

5.5.1.3.7 Power Output

a. Position the COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 5-V rms, 350-Hz audio signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4 and AUDIO GND pin 2 and observe indication. Result: Not less than 4 V rms.
c. Repeat steps a and b for audio frequencies of 1000 and 3000 Hz. Result: Not less than 4 V rms for each frequency.

5.5.1.3.8 Frequency Response

a. Position the COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 1000-Hz audio signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4 and AUDIO GND pin 2. Adjust generator audio output level until 4 V rms is observed on meter. This is the 0-dB output reference level.
c. Apply a 350-Hz audio signal and observe the output indication. Result: Within ±3 dB of reference (0 dB).
d. Apply a 3000-Hz audio signal and observe the output indication. Result: Within ±3 dB of reference (0 dB).

5.5.1.3.9 Signal-to-Noise Ratio

a. Position the COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 5-V rms, 3000-Hz input signal.
b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4 and AUDIO GND P102 pin 2. Observe and record indication in dB.
c. Remove audio input signal and observe indication. Result: Signal-to-noise ratio not less than 40 dB.

5.5.1.3.10 Muting

a. Set microphone selector switch to COM 1. Position COM 1 toggle switch to SPEAKER. Connect the audio generator to COM 1 AUDIO P102 pin 17 and AUDIO GND P102 pin 2. Apply a 5-V rms, 3000-Hz input signal.

b. Connect ac voltmeter to CABIN SPEAKER (3.2Ω) P102 pin 4, and AUDIO GND P102 pin 2. Record indicated output in dB.
c. Ground AIRCRAFT KEYLINE P102 pin 8, and observe ac voltmeter indication. Result: Not less than 40-dB difference from indication recorded in step b.
d. Remove AIRCRAFT KEYLINE ground. Remove ac voltmeter and connect oscilloscope in its place. Reapply ground to AIRCRAFT KEYLINE P102 pin 8 and observe the fall time of the waveform. Result: Fall time not more than 10 ms.
e. Remove the AIRCRAFT KEYLINE ground and measure waveform rise time. Result: Rise time not more than 100 ms.

Collins MKR-350 Marker Receiver
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

Rockwell International

diagrams

Collins General Aviation Division
523-0766041-106118
6th Edition, 9 June 1982
1st Revision, 30 July 1984
Printed in USA

list of illustrations

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	30 Jul 84
*List of Effective Pages	30 Jul 84
6-1	1 Jun 78
6-2 thru 6-3	9 Jun 82
6-4 Blank	15 Jun 76
6-5	9 Jun 82
*6-6	30 Jul 84
6-7	9 Jun 82
*6-8	30 Jul 84
6-9 thru 6-12	9 Jun 82
6-13	1 Jun 78
6-14 Blank	15 Jun 76
6-15 thru 6-17	9 Jun 82
6-18 thru 6-19	15 Nov 76
6-20 Blank	15 Jun 76
6-21	15 Jun 76
6-22 thru 6-23	9 Jun 82
6-24 Blank	15 Jun 76
6-25 thru 6-26	9 Jun 82
6-26A	9 Jun 82
6-26B	9 Jun 82
6-27 thru 6-29	9 Jun 82
6-30 Blank	15 Nov 76
6-31 thru 6-32	15 Nov 76
6-33	9 Jun 82
6-34 Blank	15 Nov 76
6-35 thru 6-37	9 Jun 82
6-38 Blank	15 Nov 76
6-39 thru 6-40	9 Jun 82
6-40A	9 Jun 82
6-40B	9 Jun 82
6-41 thru 6-43	9 Jun 82
6-44 Blank	15 Nov 76
6-45	9 Jun 82
6-46	15 Nov 76
6-47 thru 6-50	9 Jun 82
*6-51	30 Jul 84
6-52 Blank	15 Nov 76
6-53	9 Jun 82
*6-54 thru 6-56	30 Jul 84
6-57 thru 6-58	9 Jun 82
*6-59	30 Jul 84
*6-60 Blank	30 Jul 84
*6-60A Added	30 Jul 84
*6-60B Blank Added	30 Jul 84
*6-60C thru 6-60G Added	30 Jul 84
*6-60H Blank Added	30 Jul 84
6-60I	Not Used
*6-60J Added	30 Jul 84
*6-60K Blank Added	30 Jul 84
*6-60L Added	30 Jul 84
*6-60M Blank Added	30 Jul 84
6-61	9 Jun 82
6-62 Blank	15 Jun 76
6-63 thru 6-70	9 Jun 82
6-70A	9 Jun 82
6-70B Blank	9 Jun 82
6-71 thru 6-73	9 Jun 82
6-74 Blank	15 Nov 76
6-75 thru 6-77	9 Jun 82
6-78	15 Nov 76
*6-79	30 Jul 84
6-80 thru 6-85	9 Jun 82
6-86 Blank	15 Nov 76
6-87 thru 6-94	9 Jun 82
6-94A	9 Jun 82
6-94B Blank	9 Jun 82
6-95 thru 6-97	9 Jun 82
6-98 Blank	15 Nov 76
6-99 thru 6-101	9 Jun 82
6-102	15 Nov 76
6-103 thru 6-107	9 Jun 82
6-108 Blank	15 Nov 76

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL,
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None
2nd Ed	1 Sep 75		AMR-350/350H AUD-250/250H SIL 1-75, 2-75
			AMR-350H SB 1
3rd Ed	15 Jun 76		Same as 2nd edition plus all audio panels SIL 1-76
4th Ed	15 Nov 76		Same as 3rd edition
5th Ed	1 Jun 78		All of the above plus MKR-350: SB 1, 2, SIL 1-77, 2-77; AUD-250: SB 1, 2, 3, SIL 1-77, 2-77; AUD-250H: SB 1, 2, 3, SIL 1-77, 2-77; AUD-251H: SIL 1-76; AMR-350: SB 1, 2, 3, SIL 1-77 thru 4-77; AMR-350H: SB 2, 3, 4, SIL 1-77 thru 4-77
6th Ed	9 Jun 82		All of the above plus AMR-350: SB 2R1, 4, 5R1, 6, SIL 1-79, 2-79, 3-79, AMR-350H SB 5, 6, 7, 8, SIL 1-79, 2-79, 3-79; MKR-350 SB 3, 4, SIL 1-79; AUD-250 SIL 1-79; AUD 250H SB 3R1, 4, SIL 1-79; AUD-251H SB 2, 3R1, 4, SIL 1-78
1	30 Jul 84		Same as above

section VI
diagrams

6.1 CONFIGURATION STATUS CONTROL

Collins General Aviation Division of Rockwell International uses the following method of identifying the configuration status of a unit or subassembly

A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — if no changes have been processed. The first change will be identified as A, the second as B, and continuing through Z to AA, AB, and ultimately to ZZ. Incorporation of design changes in a unit or subassembly that has been returned to Rockwell-Collins for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F and unit two is marked REV F. This indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

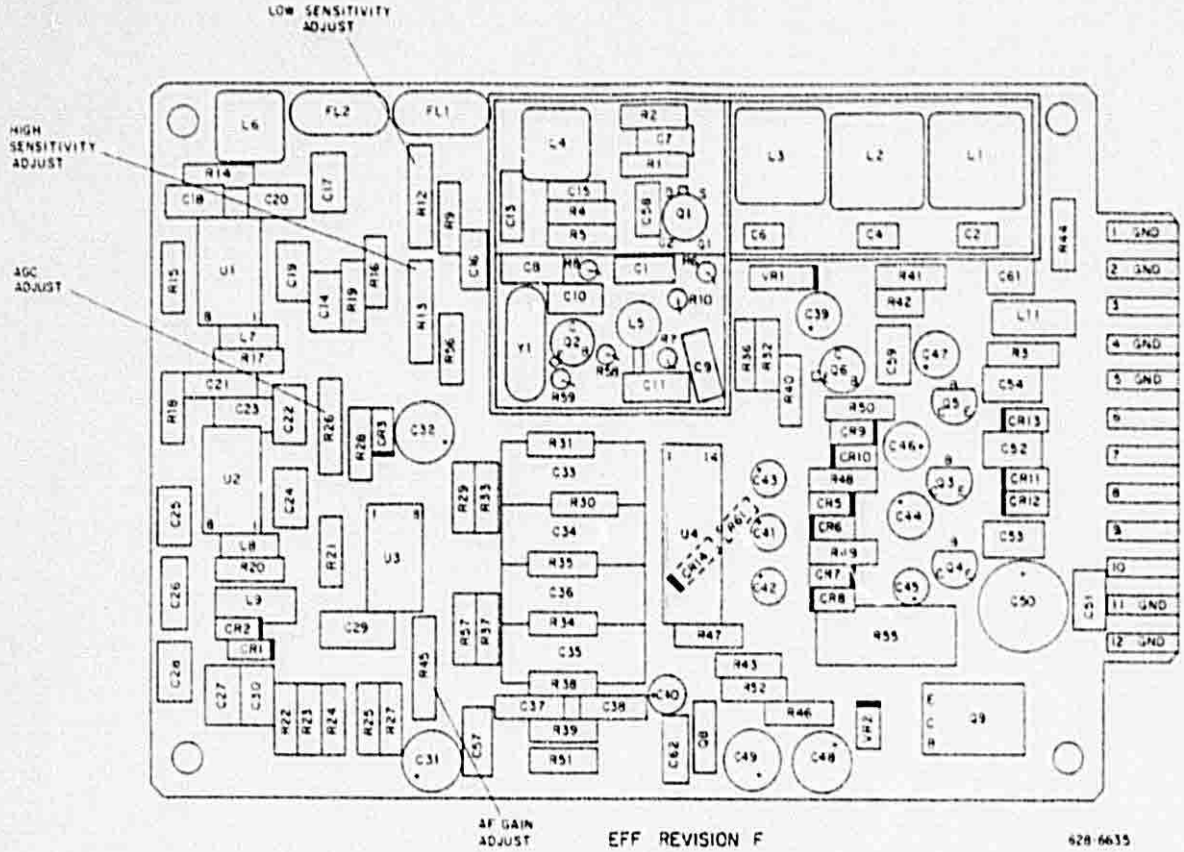
A reworked unit may not contain all design changes made to the reworked identifier, but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may physically appear different from a newly manufactured unit with the same alphabetic identifier.

Only alphabetic identifiers that result in schematic changes are covered in this section. If a unit or subassembly has an identifier that alphabetically falls between identifiers on the schematic changes pages, or after the last identifier on the schematic changes page up to and including the latest effectivity listed below, the electrical configuration is represented by the earlier identifier listed on the schematic changes page.

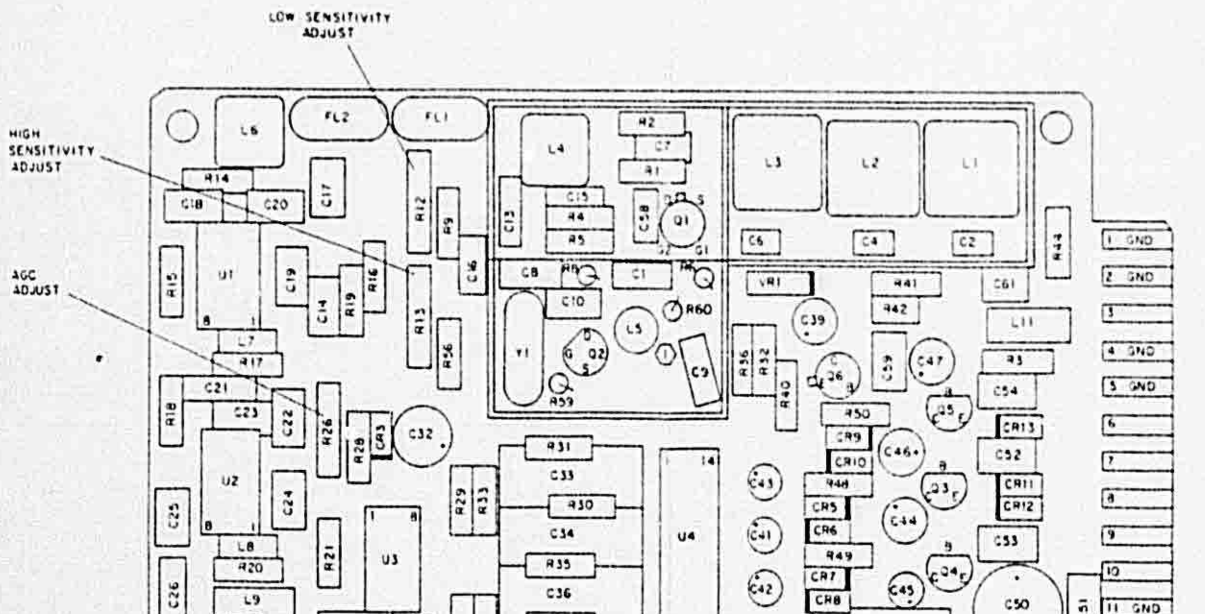
6.2 SCHEMATIC DIAGRAMS

The schematic diagrams and component location diagrams are provided in figures 6-1 through 6-31.

A schematic change sheet precedes each schematic. The change sheet provides a description of schematic changes, a reason for the changes, the service bulletin number (if applicable) that modifies the unit, and the production cut-in effectivity for the change. Component locations are provided on facing pages.



Marker Beacon Receiver, Component Location Diagram, Effective Revision F
Figure 6-1



NOTES:
(1) R60 IS ADDED EFF REVISION R

Marker Beacon Receiver, Component Location Diagram, Effective Revision P
Figure 6-1A

SEE BLOW–UP FICHE NO. CRL103 - ITEM A

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Changed value of R7 from 15 to 1.5 kΩ, R58 from 18 to 1.8 kΩ, and C8 from 150 to 120 pF to improve oscillator performance.	SB 1	REV L
	Changed value of R24 from 56 to 82 kΩ and fixed biased 2nd if to improve dynamic range.	NA	REV L
2	Changed C51 from 0.05 to 0.047 to incorporate capacitor with 50-V working voltage.	SB 2	REV M
3	Deleted old note 4.	NA	REV N
D	Redesigned local oscillator to eliminate interference with transponder. Refer to schematic apron for circuit configuration prior to REV P.	SB 3	REV P
E	Corrected polarity of C41, C42 and C43.	NA	NA
F	Added R60 to prevent possibility of noncrystal controlled oscillation.	NA	REV R
G	Added CR14, R61, and changed R51 from 10 to 6.34 kΩ and R52 from 10% to 1% part for middle marker use as autopilot gain programming.	SB 4	REV T

Marker Beacon Receiver, Effective Revision F, Schematic Diagram
Figure 6-2 (Sheet A)

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISION F
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
C1	CAPACITOR, FIXED, MICA DIELECTRIC, 5PF ±1/2PF, 300V	912-2106-090
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C3	NOT USED	
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C5	NOT USED	
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C8	CAPACITOR, FIXED, MICA DIEL, 68PF, ±5%, 300V (EFF REV P; SB 3)	912-2099-250
C8	CAPACITOR, FIXED, MICA DIEL, 120PF, 5%, 300V (EFF REV L; SB 1)	912-2106-150
C8	CAPACITOR, FIXED, MICA DIELECTRIC, 150PF, ±5%, 300V	912-2106-100
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C10	CAPACITOR, FIXED, MICA DIEL, 12PF, ±1/2PF, 300V (EFF REV P; SB 3)	912-2099-100
C10	CAPACITOR, FIXED, MICA DIELECTRIC, 10PF, ±1/2PF, 300V	912-2106-020
C11	NOT USED (EFF REV P; SB 3)	
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C12	NOT USED	
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISION F
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C29	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C31	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C32	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C33	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-160
C34	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-160
C35	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.01UF, ±5%, 100V	933-1404-150
C36	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.01UF, ±5%, 100V	933-1404-150
C37	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 3300PF, ±5%, 100V	933-1404-140
C38	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 3300PF, ±5%, 100V	933-1404-140
C39	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C40	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C41	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C42	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C43	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C44	CAPACITOR, FIXED, TANTALUM, 10UF, ±20%, 20V	184-9113-070
C45	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C46	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C47	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C48	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 16V	183-1471-100
C49	CAPACITOR, FIXED, ELECTROLYTIC, 33UF, +100-20%, 16V	183-1471-040
C50	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 35V	183-1471-190

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISION F
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
C51	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.047UF, 20%, 50V	913-3306-060
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C54	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C55	NOT USED	
C56	NOT USED	
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C60	NOT USED	
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05PF, +80-20%, 12V	913-3298-010
CR1	DIODE, 1N4454	353-3741-010
CR2	DIODE, 1N4454	353-3741-010
CR3	DIODE, 1N4454	353-3741-010
CR4	NOT USED	
CR5	DIODE, 1N4454	353-3741-010
CR6	DIODE, 1N4454	353-3741-010
CR7	DIODE, 1N4454	353-3741-010
CR8	DIODE, 1N4454	353-3741-010
CR9	DIODE, 1N4454	353-3741-010
CR10	DIODE, 1N4454	353-3741-010
CR11	DIODE, 1N4454	353-3741-010
CR12	DIODE, 1N4454	353-3741-010
CR13	DIODE, 1N4454	353-3741-010
CR14	DIODE, 1N4454 (EFF REV T; SB 4)	353-3741-010
DS1	LAMP	262-1398-070
DS2	LAMP	262-1398-070
DS3	LAMP	262-1398-070
FL1	FILTER, BANDPASS, CRYSTAL, 10.7MHz	293-1305-010
FL2	FILTER, BANDPASS, CRYSTAL, 10.7MHz	293-1305-010
L1	COIL, 75MHz	278-0420-010
L2	COIL, 75MHz	278-0420-010
L3	COIL, 75MHz	278-0420-010
L4	COIL, 10.7MHz	278-0419-010
L5	COIL, VARIABLE	242-0438-010
L6	COIL, 10.7MHz	278-0419-010
L7	COIL, 3.3UH	240-2742-160
L8	COIL, 3.3UH	240-2742-160
L9	COIL, 100UH	240-2742-170
L10	NOT USED	

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISION F
ASSEMBLY 628-7605-001

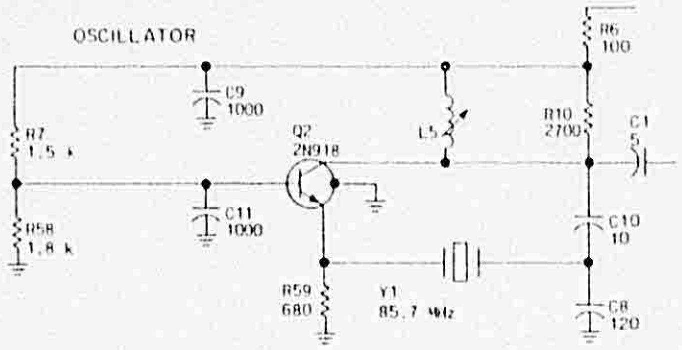
SYMBOL	DESCRIPTION	PART NUMBER
L11	COIL, 0.68UH	240-2742-020
Q1	TRANSISTOR, 40841	352-5005-010
Q2	TRANSISTOR, SPF-703-2 (EFF REV P; SB 3)	352-5013-030
Q2	TRANSISTOR, 2N918	352-5027-020
Q3	TRANSISTOR, MPS A-14	352-5035-010
Q4	TRANSISTOR, MPS A-14	352-5035-010
Q5	TRANSISTOR, MPS A-14	352-5035-010
Q6	TRANSISTOR, 2N2222A	352-5021-010
Q7	NOT USED	
Q8	TRANSISTOR, MJE-800	352-5028-010
Q9	TRANSISTOR, MJE-182	352-5011-010
R1	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R2	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 10%, 1/4W	745-7950-130
R3	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 10%, 1/4W	745-7950-140
R4	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 10%, 1/4W	745-7950-370
R5	RESISTOR, FIXED, COMPOSITION, 180 OHMS, 10%, 1/4W	745-7950-160
R6	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 10%, 1/4W	745-7950-130
R7	NOT USED (EFF REV P; SB 3)	
R7	RESISTOR, FXD, CMPSN, 1.5K, 10%, 1/4W (EFF REV L; SB 1)	745-7950-270
R7	RESISTOR, FIXED, COMPOSITION, 15K, 10%, 1/4W	745-7950-390
R8	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R9	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R10	NOT USED (EFF REV P; SB 3)	
R10	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R11	NOT USED	
R12	RESISTOR, VARIABLE, 2K, ±30%, 1/2W	382-0500-020
R13	RESISTOR, VARIABLE, 2K, ±30%, 1/2W	382-0500-020
R14	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R15	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R16	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R17	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R18	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R19	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R20	RESISTOR, FIXED, COMPOSITION, 820 OHMS, 10%, 1/4W	745-7950-240
R21	RESISTOR, FIXED, COMPOSITION, 3.9K, 10%, 1/4W	745-7950-320
R22	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R23	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R24	RESISTOR, FXD, CMPSN, 82K, 10%, 1/4W (EFF REV L)	745-7950-480
R24	RESISTOR, FIXED, COMPOSITION, 56K, 10%, 1/4W	745-7950-460
R25	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R26	RESISTOR, VARIABLE, 10K, 30%, 1/2W	382-0500-030
R27	RESISTOR, FIXED, COMPOSITION, 3.3K, 10%, 1/4W	745-7950-310
R28	RESISTOR, FIXED, COMPOSITION, 4.7K, 10%, 1/4W	745-7950-330
R29	RESISTOR, FIXED, FILM, 12,100 OHMS, ±1%, 1/8W	745-7957-310
R30	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R31	RESISTOR, FIXED, FILM, 1820 OHMS, ±1%, 1/8W	745-7956-510
R32	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISION F
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
R33	RESISTOR, FIXED, FILM, 10,000 OHMS, ±1%, 1/8W	745-7957-230
R34	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R35	RESISTOR, FIXED, FILM, 1620 OHMS, ±1%, 1/8W	745-7956-460
R36	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R37	RESISTOR, FIXED, FILM, 15,000 OHMS, ±1%, 1/8W	745-7957-400
R38	RESISTOR, FIXED, FILM, 130,000 OHMS, ±1%, 1/8W	745-7403-310
R39	RESISTOR, FIXED, FILM, 2100 OHMS, ±1%, 1/8W	745-7956-570
R40	RESISTOR, FIXED, FILM, 130K, 1%, 1/8W	745-7403-310
R41	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 560K, 10%, 1/4W	745-7950-580
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 680K, 10%, 1/4W	745-7950-590
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 820K, 10%, 1/4W	745-7950-600
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1M, 10%, 1/4W	745-7950-610
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1.2M, 10%, 1/4W	745-7950-620
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1.5M, 10%, 1/4W	745-7950-630
R43	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R44	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R45	RESISTOR, VARIABLE, 10K, 30%, 1/2W	382-0500-030
R46	RESISTOR, FIXED, COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R47	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R48	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R49	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R50	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R51	RESISTOR, FXD, FILM, 6.34K, 1%, 1/8W (EFF REV T; SB 4)	705-3605-380
R51	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R52	RESISTOR, FIXED, FILM, 10K, 1%, 1/8W (EFF REV T; SB 4)	705-1044-000
R52	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R53	NOT USED	
R54	NOT USED	
R55	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1W	745-7952-210
R56	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R57	RESISTOR, FIXED, COMPOSITION, 1.2K, 10%, 1/4W	745-7950-260
R58	RESISTOR, FIXED, COMPOSITION, 1.8K, 10%, 1/4W (EFF REV L; SB 1)	745-7950-280
R58	NOT USED (EFF REF P; SB 3)	
R58	RESISTOR, FIXED, COMPOSITION, 18K, 10%, 1/4W	745-7950-400
R59	RESISTOR, FIXED, COMPOSITION, 680 OHMS, 10%, 1/4W	745-7950-230
R60	RESISTOR, FXD, CMPSN, 4.7K, 10%, 1/4W (EFF REV R)	745-7950-330
R61	RESISTOR, FXD, CMPSN, 47K, 10%, 1/4W (EFF REV T; SB 4)	745-7950-450

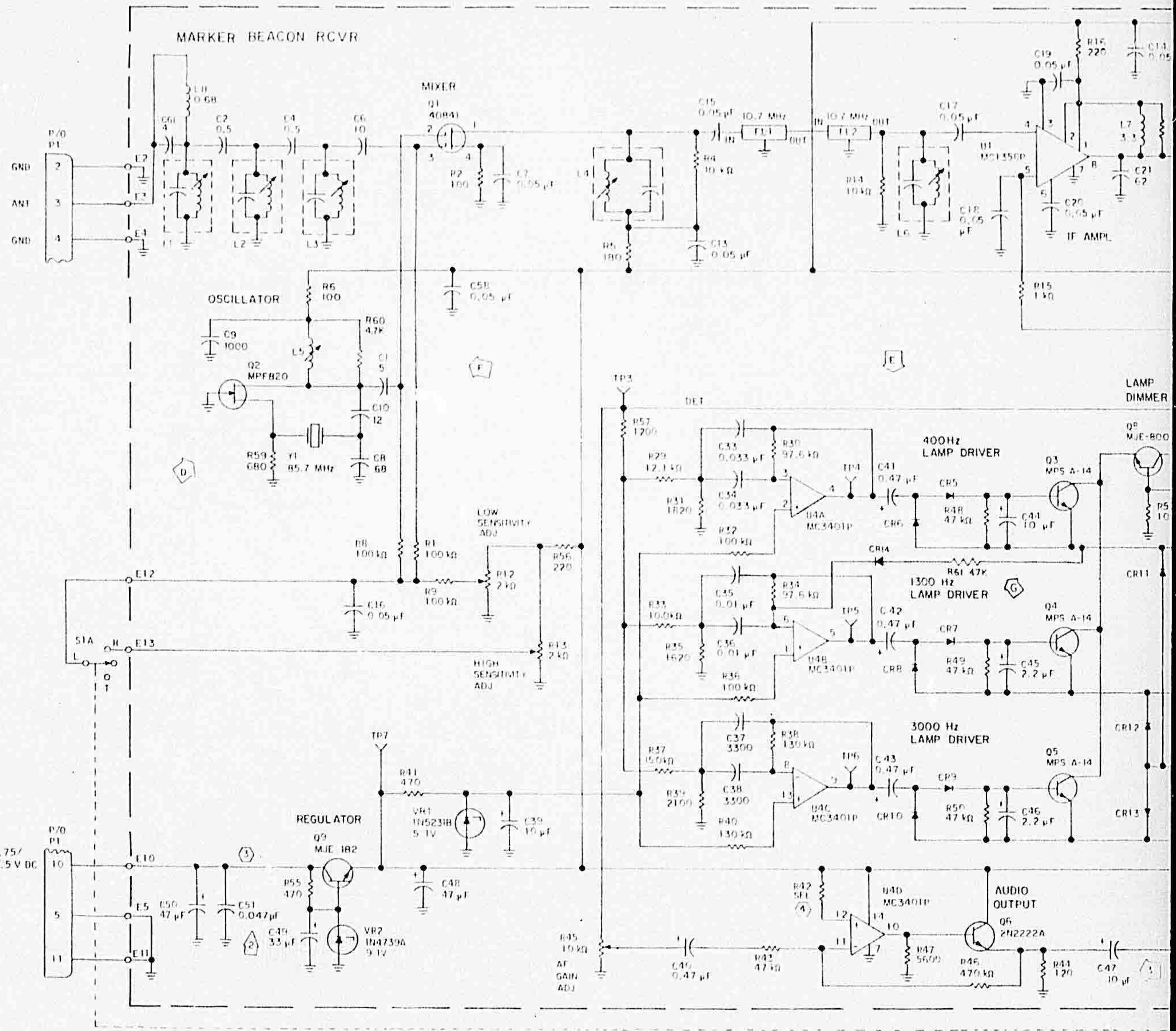
PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISION F
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
S1	SWITCH TOGGLE	266-5417-020
U1	INTEGRATED CIRCUIT, 1350P	351-1134-010
U2	INTEGRATED CIRCUIT, 1350P	351-1134-010
U3	INTEGRATED CIRCUIT, 1458CP1	351-1156-020
U4	INTEGRATED CIRCUIT, 3401P	351-1611-010
V1	PHOTOCELL	353-0449-010
VR1	ZENER DIODE, 1N5231B	353-3740-210
VR2	ZENER DIODE, 1N4739A	353-3737-130
Y1	CRYSTAL, QUARTZ, 85.70MHz	289-7260-020



BEFORE REV P/ 5B3

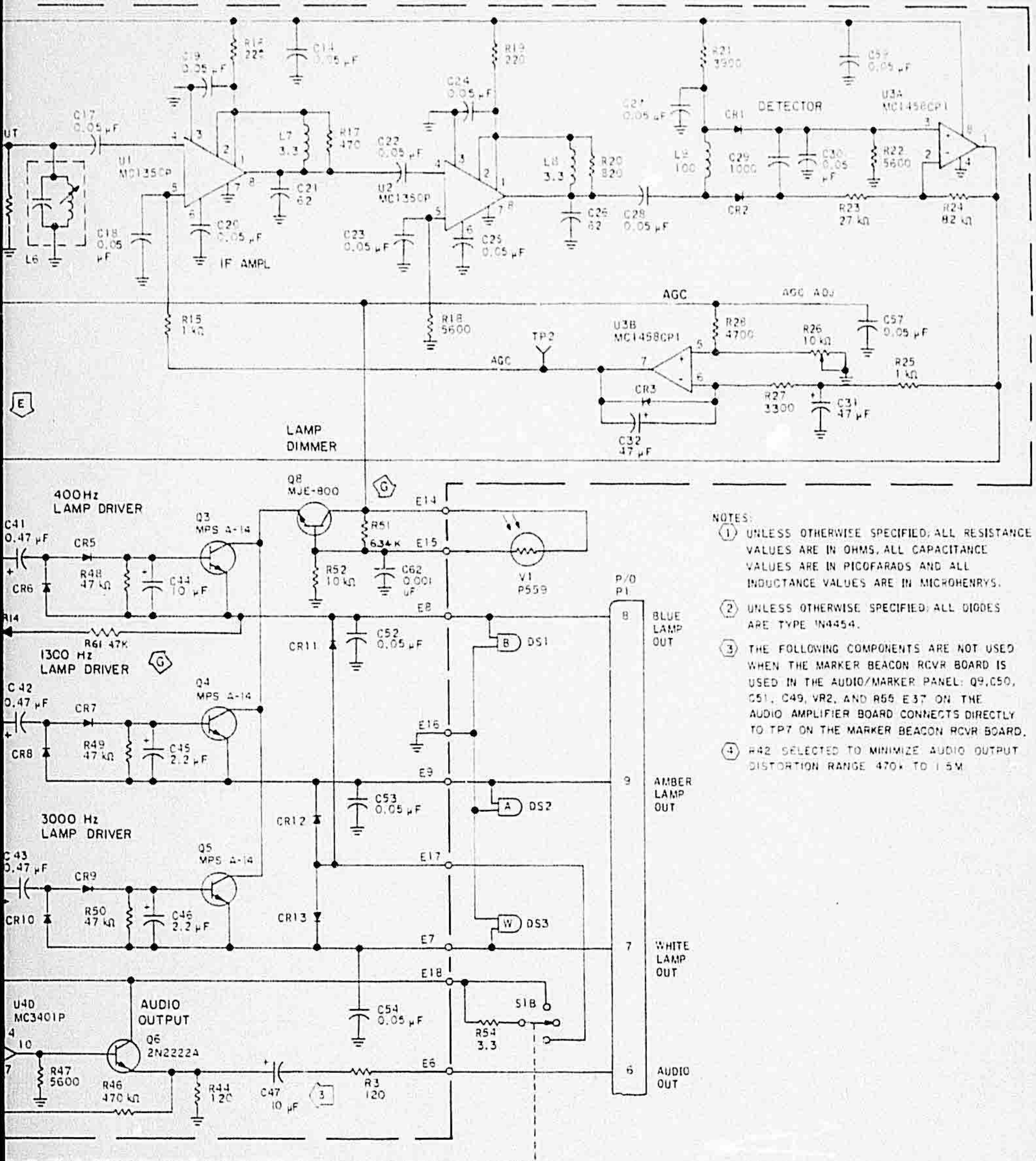
628-8164



PG 6-11

SEE BLOW-UP FICHE NO. CRL103 - ITEM E

SEE BLOW-UP FICHE NO. CRL103

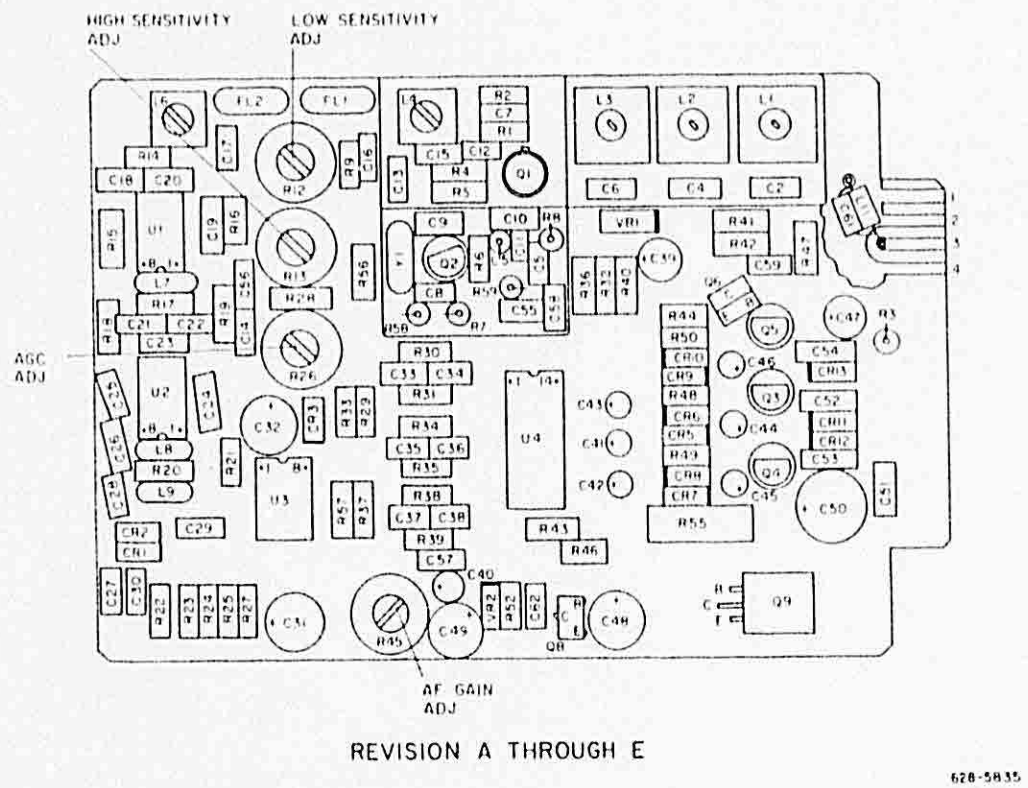


NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. UNLESS OTHERWISE SPECIFIED, ALL DIODES ARE TYPE 1N4454.
3. THE FOLLOWING COMPONENTS ARE NOT USED WHEN THE MARKER BEACON RCVR BOARD IS USED IN THE AUDIO/MARKER PANEL: Q9, C50, C51, C49, VR2, AND R55. E37 ON THE AUDIO AMPLIFIER BOARD CONNECTS DIRECTLY TO TP7 ON THE MARKER BEACON RCVR BOARD.
4. R42 SELECTED TO MINIMIZE AUDIO OUTPUT DISTORTION. RANGE 470k TO 1.5M.

Marker Beacon Receiver, Effective Revision F, Schematic Diagram
Figure 6-2

SEE BLOW-UP FICHE NO. CRL103 - ITEM E



Marker Beacon Receiver, Component Location Diagram, Effective Revisions A Through E
Figure 6-3

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Corrected schematic error; capacitor C48 was included twice.	NA	NA
2	Changed value of R40 from 100 to 130 kΩ. Made R42 a test select; was 1 MΩ. Revised to adjust Q points of op amps to minimize audio peak clipping.	NA	REV D

Marker Beacon Receiver, Effective Revisions A Through E, Schematic Diagram
Figure 6-4 (Sheet A)

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISIONS A THROUGH E
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
C1	NOT USED	
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C3	NOT USED	
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C5	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C8	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 33PF, ±5%, 50V	913-3308-160
C10	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 47PF, ±5%, 50V	913-3308-180
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22PF, ±5%, 50V	913-3308-140
C12	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22,000PF, +80-20%, 50V	913-3311-020
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22,000PF, +80-20%, 50V	913-3311-020
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISIONS A THROUGH E
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C29	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 1000PF, ±10%, 50V	933-1409-010
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C31	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C32	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C33	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 33,000PF, ±5%, 50V	933-1409-060
C34	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 33,000PF, ±5%, 50V	933-1409-060
C35	CAPACITOR, FIXED, PLASTIC DIELECTRIC, .01UF, ±5%, 50V	933-1409-050
C36	CAPACITOR, FIXED, PLASTIC DIELECTRIC, .01UF, ±5%, 50V	933-1409-050
C37	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 3300PF, ±5%, 50V	933-1409-040
C38	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 3300PF, ±5%, 50V	933-1409-040
C39	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C40	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C41	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C42	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C43	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C44	CAPACITOR, FIXED, TANTALUM, 10UF, ±20%, 20V	184-9113-070
C45	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C46	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C47 (AMR ONLY)	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C47 (MKR ONLY)	CAPACITOR, FIXED, TANTALUM, 4.7UF, ±20%, 10V	184-9113-050
C48	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 16V	183-1471-100
C49	CAPACITOR, FIXED, ELECTROLYTIC, 33UF, +100-20%, 16V	183-1471-040
C50	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 35V	183-1471-190
C51	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISIONS A THROUGH E
ASSEMBLY 628-7605-001

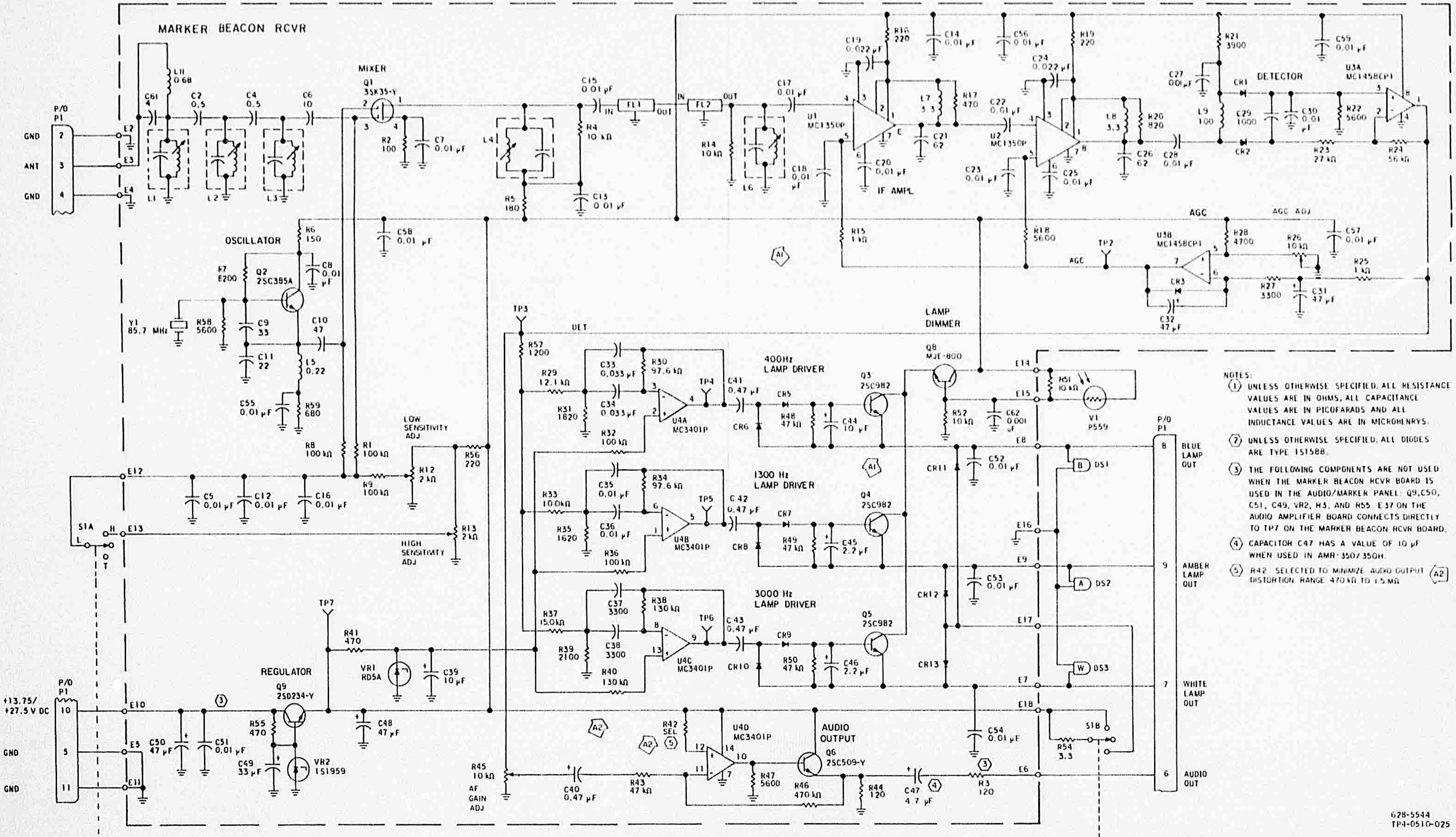
SYMBOL	DESCRIPTION	PART NUMBER
C54	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C55	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C56	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C60	NOT USED	
C61	CAPACITOR, FIXED, CERAMIC, DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
C62	CAPACITOR, FIXED, CERAMIC, DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
CR1	DIODE, 1S1588	353-0450-010
CR2	DIODE, 1S1588	353-0450-010
CR3	DIODE, 1S1588	353-0450-010
CR4	NOT USED	
CR5	DIODE, 1S1588	353-0450-010
CR6	DIODE, 1S1588	353-0450-010
CR7	DIODE, 1S1588	353-0450-010
CR8	DIODE, 1S1588	353-0450-010
CR9	DIODE, 1S1588	353-0450-010
CR10	DIODE, 1S1588	353-0450-010
CR11	DIODE, 1S1588	353-0450-010
CR12	DIODE, 1S1588	353-0450-010
CR13	DIODE, 1S1588	353-0450-010
DS1	LAMP	262-1398-070
DS2	LAMP	262-1398-070
DS3	LAMP	262-1398-070
FL1	FILTER, BANDPASS, CRYSTAL, 10.7MHZ	293-1305-010
FL2	FILTER, BANDPASS, CRYSTAL, 10.7MHZ	293-1305-010
L1	COIL, 75MHZ	278-0420-010
L2	COIL, 75MHZ	278-0420-010
L3	COIL, 75MHZ	278-0420-010
L4	COIL, 10.7MHZ	278-0419-010
L5	COIL, .22UH	240-2742-210
L6	COIL, 10.7MHZ	278-0419-010
L7	COIL, 3.3UH	240-2742-160
L8	COIL, 3.3UH	240-2742-160
L9	COIL, 100UH	240-2742-170
L10	NOT USED	
L11	COIL, .68UH	240-2742-020
Q1	TRANSISTOR, 3SK35Y	352-5042-010
Q2	TRANSISTOR, 2SC 385A-GR	352-5047-010
Q3	TRANSISTOR, 2SC982	352-5043-010

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISIONS A THROUGH E
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
Q4	TRANSISTOR, 2SC982	352-5043-010
Q5	TRANSISTOR, 2SC982	352-5043-010
Q6	TRANSISTOR, 2SC509Y	352-5046-010
Q7	NOT USED	
Q8	TRANSISTOR, MJE-800	352-5028-010
Q9	TRANSISTOR, 2SD234-Y	352-5041-010
R1	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R2	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 5%, 1/4W	745-7958-030
R3	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 10%, 1/4W	745-7950-140
R4	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R5	RESISTOR, FIXED, COMPOSITION, 180 OHMS, 5%, 1/4W	745-7958-060
R6	RESISTOR, FIXED, COMPOSITION, 150 OHMS, 5%, 1/4W	745-7958-050
R7	RESISTOR, FIXED, COMPOSITION, 8200 OHMS, 5%, 1/4W	745-7958-280
R8	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R9	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R10	NOT USED	
R11	NOT USED	
R12	RESISTOR, VARIABLE, 2000 OHMS, ±20%, 0.5W	382-0045-020
R13	RESISTOR, VARIABLE, 2000 OHMS, ±20%, 0.5W	382-0045-020
R14	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R15	RESISTOR, FIXED, COMPOSITION, 1000 OHMS, 5%, 1/4W	745-7958-170
R16	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R17	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R18	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R19	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R20	RESISTOR, FIXED, COMPOSITION, 820 OHMS, 5%, 1/4W	745-7958-160
R21	RESISTOR, FIXED, COMPOSITION, 3900 OHMS, 5%, 1/4W	745-7958-240
R22	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R23	RESISTOR, FIXED, COMPOSITION, 27,000 OHMS, 5%, 1/4W	745-7958-340
R24	RESISTOR, FIXED, COMPOSITION, 56,000 OHMS, 5%, 1/4W	745-7958-390
R25	RESISTOR, FIXED, COMPOSITION, 1000 OHMS, 5%, 1/4W	745-7958-170
R26	RESISTOR, VARIABLE, 10,000 OHMS, ±20%, 1/4W	382-0045-030
R27	RESISTOR, FIXED, COMPOSITION, 3300 OHMS, 5%, 1/4W	745-7958-230
R28	RESISTOR, FIXED, COMPOSITION, 4700 OHMS, 5%, 1/4W	745-7958-250
R29	RESISTOR, FIXED, FILM, 12,100 OHMS, ±1%, 1/8W	745-7957-310
R30	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R31	RESISTOR, FIXED, FILM, 1820 OHMS, ±1%, 1/8W	745-7956-510
R32	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R33	RESISTOR, FIXED, FILM, 10,000 OHMS, ±1%, 1/8W	745-7957-230
R34	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R35	RESISTOR, FIXED, FILM, 1620 OHMS, ±1%, 1/8W	745-7956-460
R36	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R37	RESISTOR, FIXED, FILM, 15,000 OHMS, ±1%, 1/8W	745-7957-400
R38	RESISTOR, FIXED, FILM, 130,000 OHMS, ±1%, 1/8W	745-7403-310
R39	RESISTOR, FIXED, FILM, 2100 OHMS, ±1%, 1/8W	745-7956-570
R40	RESISTOR, FIXED, FILM, 130K, ±1%, 1/8W (EFF REV D)	745-7403-310
R40	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420

PARTS LIST
MKR-350 MARKER RECEIVER; EFFECTIVE REVISIONS A THROUGH E
ASSEMBLY 628-7605-001

SYMBOL	DESCRIPTION	PART NUMBER
R41	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R42	TEST SELECT (EFF REV D)	
R42	RESISTOR, FIXED, COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R42	RESISTOR, FIXED, COMPOSITION, 560K, 10%, 1/4W	745-7950-580
R42	RESISTOR, FIXED, COMPOSITION, 680K, 10%, 1/4W	745-7950-590
R42	RESISTOR, FIXED, COMPOSITION, 820K, 10%, 1/4W	745-7950-600
R42	RESISTOR, FIXED, COMPOSITION, 1M, 10%, 1/4W	745-7950-610
R42	RESISTOR, FIXED, COMPOSITION, 1.2M, 10%, 1/4W	745-7950-620
R42	RESISTOR, FIXED, COMPOSITION, 1.5M, 10%, 1/4W	745-7950-630
R42	RESISTOR, FIXED, COMPOSITION, 1M, 5%, 1/4W	745-7958-520
R43	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R44	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R45	RESISTOR, VARIABLE, 10,000 OHMS, ±20%, 0.5W	382-0045-030
R46	RESISTOR, FIXED, COMPOSITION, .47 OHMS, 5%, 1/4W	745-7958-500
R47	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R48	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R49	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R50	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R51	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R52	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R53	NOT USED	
R54	RESISTOR, FIXED, COMPOSITION, 3.3 OHMS, 10%, 1/2W	745-7951-260
R55	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1W	745-7952-210
R56	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R57	RESISTOR, FIXED, COMPOSITION, 1200 OHMS, 5%, 1/4W	745-7958-180
R58	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R59	RESISTOR, FIXED, COMPOSITION, 680 OHMS, 5%, 1/4W	745-7958-150
S1	SWITCH TOGGLE	266-5417-020
U1	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U2	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U3	INTEGRATED CIRCUIT, MC1458CP1	351-1156-020
U4	INTEGRATED CIRCUIT, MC3401P	351-1611-010
V1	PHOTOCELL	353-0449-010
VR1	ZENER DIODE, RD5A-N	353-3740-210
VR2	ZENER DIODE, 1S1959	353-3737-130
Y1	CRYSTAL UNIT, QUARTZ, 85.70MHZ	289-7260-020

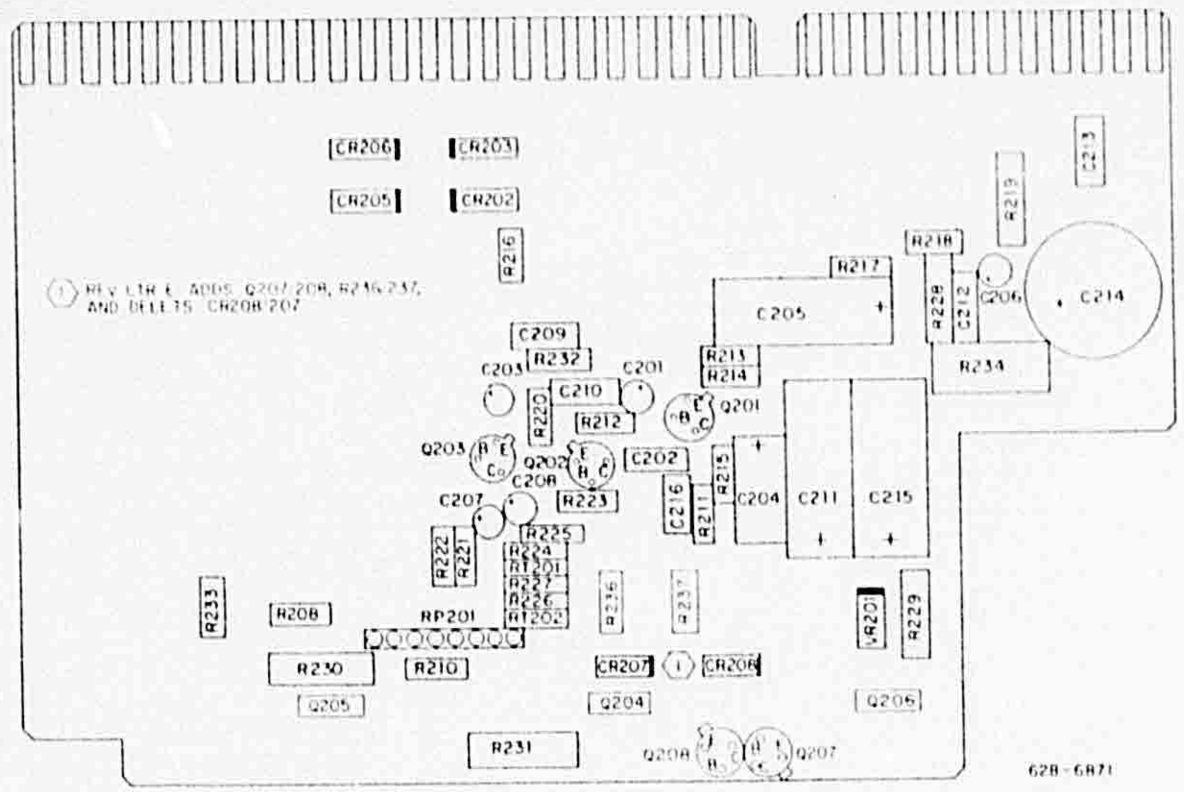


NOTES:

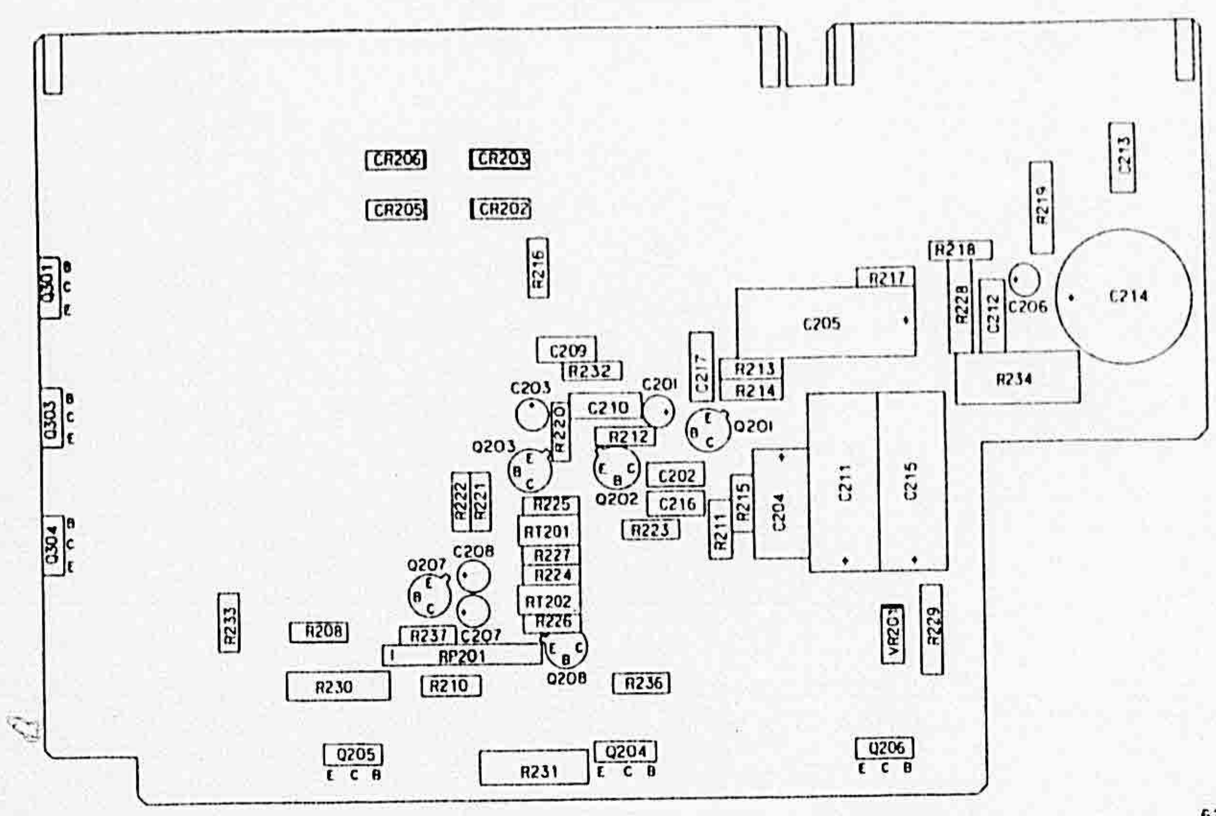
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. UNLESS OTHERWISE SPECIFIED, ALL DIODES ARE TYPE 1S1588.
3. THE FOLLOWING COMPONENTS ARE NOT USED WHEN THE MARKER BEACON RCVR BOARD IS USED IN THE AUDIO/MARKER PANEL: Q9, C50, C51, C49, VR2, R3, AND R55. E37 ON THE AUDIO AMPLIFIER BOARD CONNECTS DIRECTLY TO TP7 ON THE MARKER BEACON RCVR BOARD.
4. CAPACITOR C47 HAS A VALUE OF 10 μF WHEN USED IN AMR-350/350H.
5. R42 SELECTED TO MINIMIZE AUDIO OUTPUT DISTORTION. RANGE 470 kΩ TO 1.5 MΩ.

628-5544
TP4-0510-025

Marker Beacon Receiver, Effective Revisions A Through E, Schematic Diagram
Figure 6-4



AUD-250 Audio Panel, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-5



AUD-250 Audio Panel, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-6

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Changed value of R213 from 267 to 249 Ω, R226 and R227 from 470 Ω to 1 kΩ; changed R224 and R225 from 22 kΩ to test select components; added RT201 and RT202. Changes prevent thermal runaway in 28-V installations.	SB 1	REV D
2	Added Q207, Q208, R236, and R237. Changed Q204 and Q205 from MJE800 to MJE521. Changes prevent thermal runaway. Refer to schematic apron for diagram of affected area prior to revision E.	NA	REV E
C	Added C217 to prevent oscillation in audio amplifier when unloaded.	NA	REV H
D	Changed Q204 and Q205 from MJE 521 to 2N5191 to improve reliability.	NA	REV W

AUD-250 Audio Panel, Effective Board Number 628-6114-XXX, Schematic Diagram
Figure 6-7 (Sheet A)

PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
C1-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC DIELECTRIC 1500PF, ±5%, 100V	933-1404-120
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01 UF, +80-20%, 50V	913-3298-130
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3298-130
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C217	CAPACITOR, FXD, CER DIEL, 68PF, 20%, 1000V (EFF REV H)	913-1194-000
CR1-CR200	NOT USED	
CR201	NOT USED	
CR202	DIODE, 1N4454	353-3741-010
CR203	DIODE, 1N4454	353-3741-010
CR204	NOT USED	
CR205	DIODE, 1N4454	353-3741-010
CR206	DIODE, 1N4454	353-3741-010
CR207	NOT USED (EFF REV E)	
CR207	DIODE, 1N4454	353-3741-010
CR208	NOT USED (EFF REV E)	
CR208	DIODE, 1N4454	353-3741-010
DS1-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
Q1-Q200	NOT USED	
Q201	TRANSISTOR, 2N2222	352-5021-010
Q202	TRANSISTOR, 2N2222	352-5021-010

PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
Q203	TRANSISTOR, 2N2222	352-5021-010
Q204	TRANSISTOR 2N519, (EFF REV W)	352-0924-020
Q204	TRANSISTOR MJE 521 (EFF REV R)	352-5064-010
Q204	TRANSISTOR, MJE 800	352-5028-010
Q205	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q205	TRANSISTOR, MJE 521 (EFF REV R)	352-5064-010
Q205	TRANSISTOR, MJE 800	352-5028-010
Q206	TRANSISTOR, MJE 182	352-5011-010
Q207	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
Q208	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
R1-R207	NOT USED	
R208	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R209	NOT USED	
R210	RESISTOR, FIXED, COMPOSITION 8.2 OHMS, ±5%, 1/4W	745-7958-010
R211	RESISTOR, FIXED, COMPOSITION 22K, 10%, 1/4W	745-7950-410
R212	RESISTOR, FIXED, COMPOSITION 68K, 10%, 1/4W	745-7950-470
R213	RESISTOR, FXD, 249 OHMS, 1%, 1/8W (EFF REV D, SB 1)	745-7955-670
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W	745-7955-700
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R215	RESISTOR, FIXED, COMPOSITION 33K, ±10%, 1/4W	745-7950-430
R216	RESISTOR, FIXED, COMPOSITION 1K, 10%, 1/4W	745-7950-250
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±10%, 1/4W	745-7950-140
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, ±10%, 1/4W	745-7950-130
R219	RESISTOR, VARIABLE 1K, ±30%, 0.1W	382-0500-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, ±10%, 1/4W	745-7950-340
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R224	TEST SELECT VALUES (EFF REV G)	
R224	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R224	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R224	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R224	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R224	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R224	TEST SELECT (EFF REV D; SB 1)	
R224	RESISTOR, FIXED, COMPOSITION 22K ±10%, 1/4W	745-7950-410
R225	TEST SELECT VALUES (EFF REV G)	
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R225	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FIXED, COMPOSITION 22K ±10%, 1/4W	745-7950-410
R226	RESISTOR, FIXED, COMPOSITION 1K, ±10%, 1/4W (EFF REV D; SB 1)	745-7950-250
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210

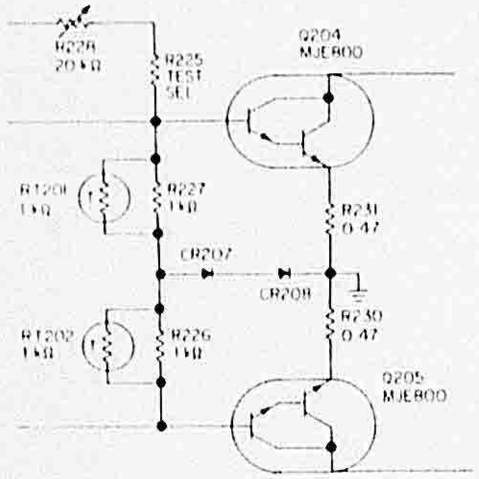
PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R228	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R229	RESISTOR, VARIABLE, 20K ±30%, 0.1W	392-0500-040
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, ±10%, 1/4W	745-7950-310
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
R235	NOT USED	
R236	RESISTOR, FXD, CMPSN, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
R237	RESISTOR, FXD, CMPSN, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
RP1-RP200	NOT USED	
RP201	RESISTOR NETWORK, 500 OHMS ±5%, 1/8W	350-4000-080
RT1-RT200	NOT USED	
RT201	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 1)	714-3255-010
RT202	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 1)	714-3255-010
S1-S100	NOT USED	
S101	SWITCH, WAFER, 3 POS	259-1024-100
S102	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-440
S103	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S104	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S105	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S106	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140

PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-6113-002

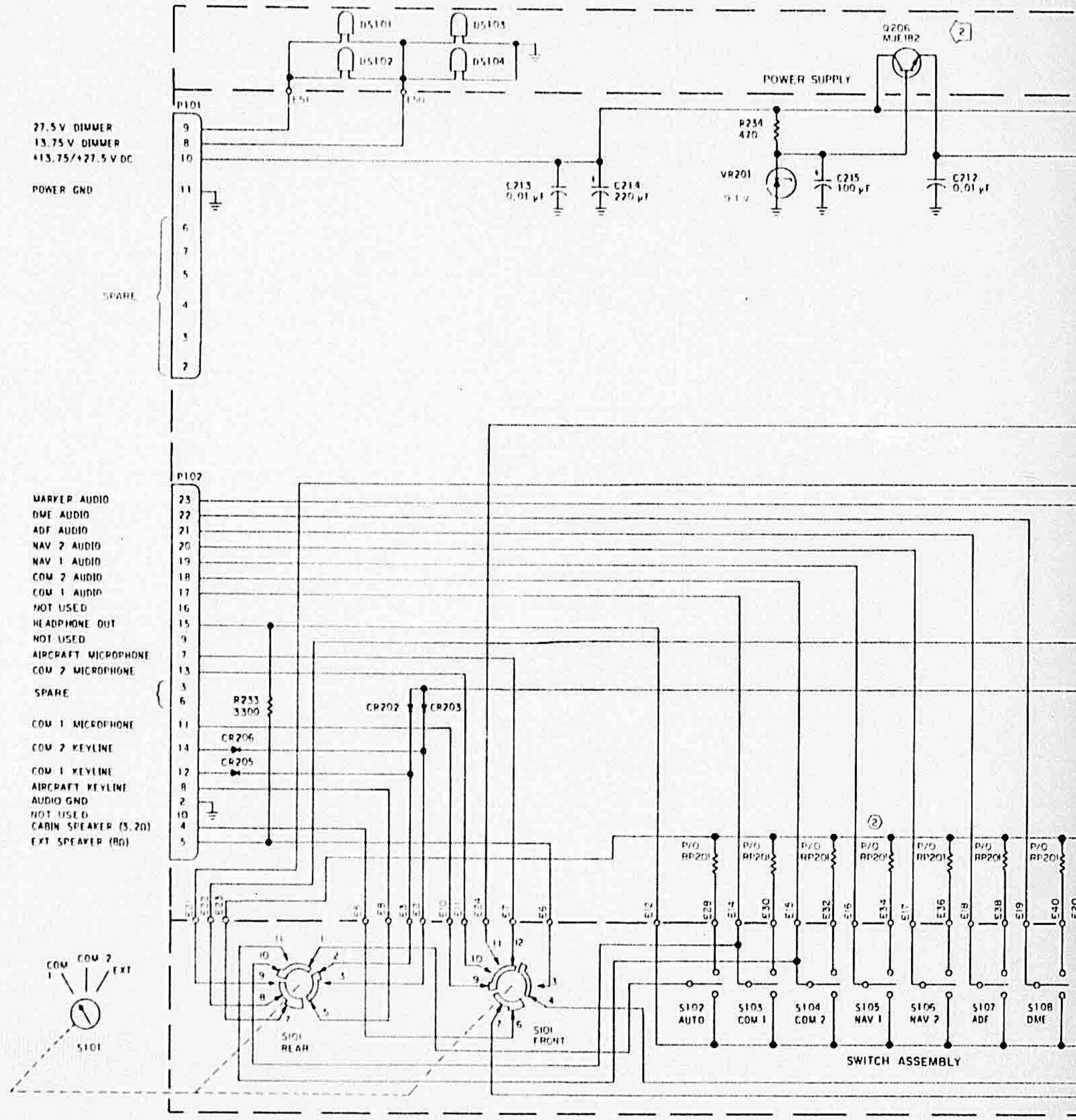
SYMBOL	DESCRIPTION	PART NUMBER
S107	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S108	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S109	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
T1-T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
VR1-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130

*PART NUMBERS ARE SWITCH/LEVER CAP.

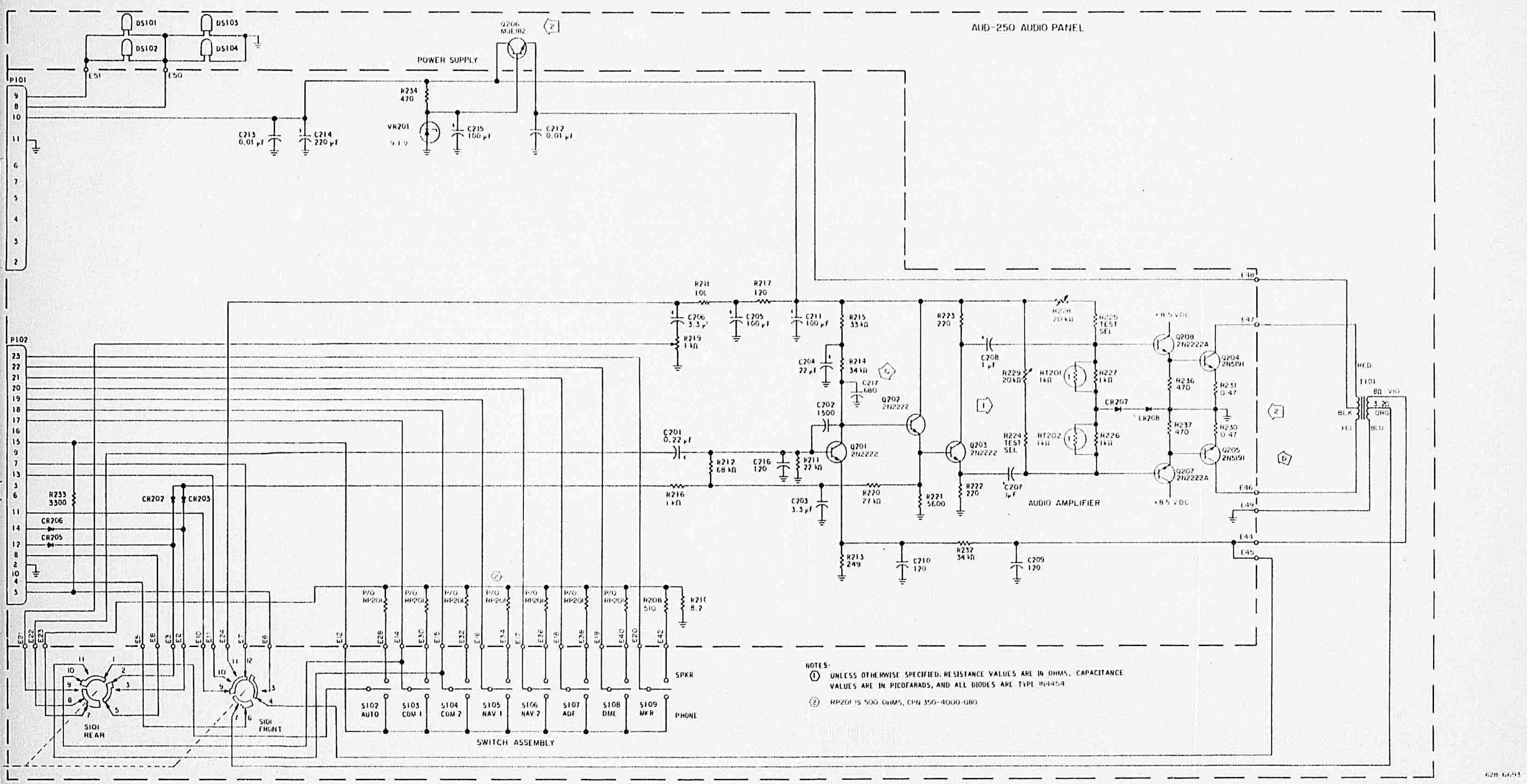


628-7475

REVISIONS A THROUGH D

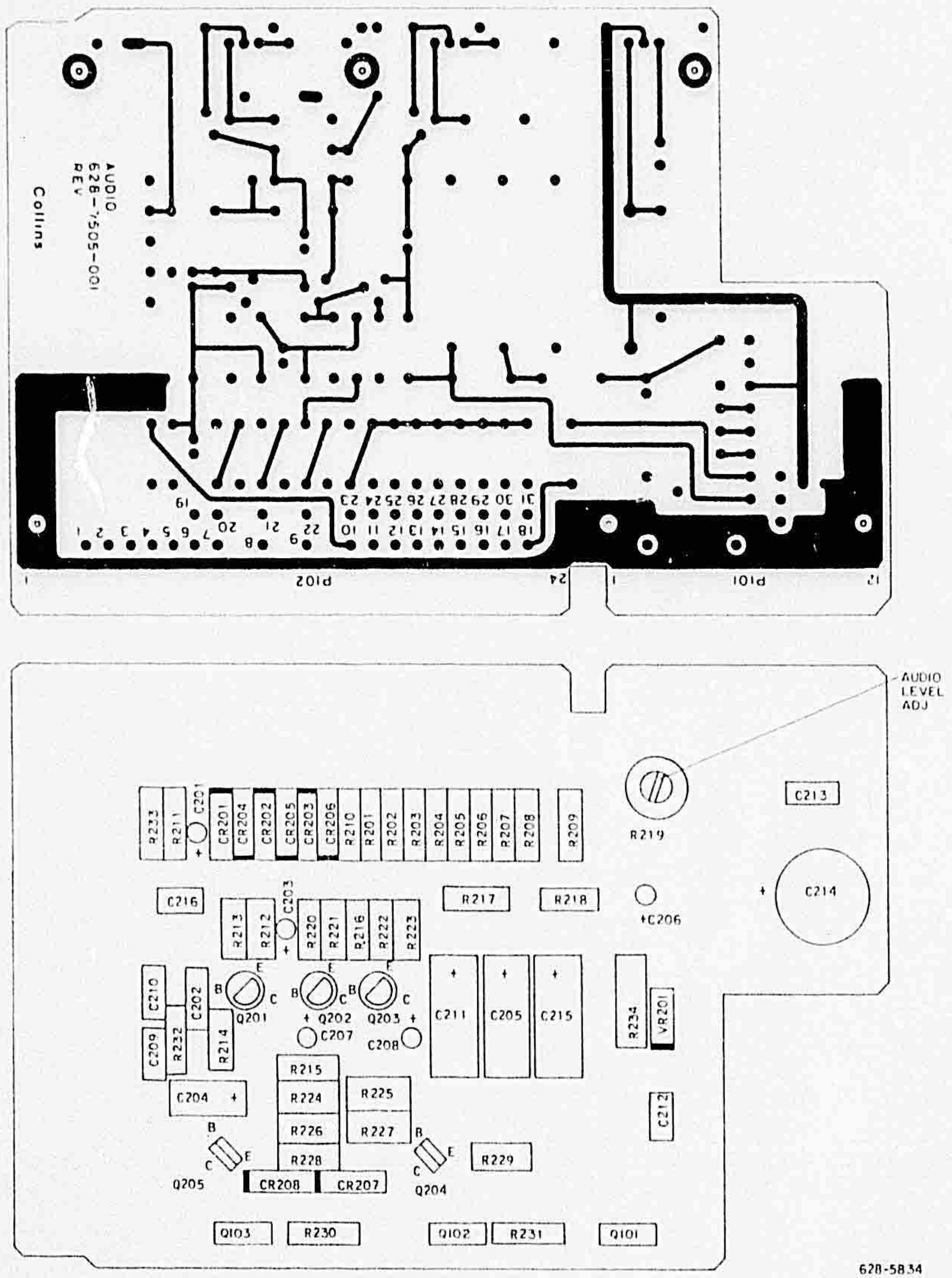


SEE BLOW-UP FICHE NO. CRL103 - ITEM 1



AUD-250 Audio Panel, Effective Board Number 628-6114-XXX,
Schematic Diagram
Figure 6-7

SEE BLOW-UP FICHE NO. CRL103 - ITEM I



NOTE: DIODES CR201 AND CR204 ARE USED IN AMR-350H AND AUD-250H UNITS ONLY.

628-5834
1P4-3110-014

AUD-250 Audio Panel, Effective Board Number 628-7505-XXX, Component Location Diagram
Figure 6-8

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Rearranged graphic configuration of switch S101 to show actual switching sequence.	NA	NA
2	Resistors R212 and R220 were 47 kΩ, R216 was 2700Ω. Values changed to ensure muting with diode in aircraft key line.	NA	REV C
3	Changed value of R214 and R232 from 33 to 34.0 kΩ and R213 from 270 to 267Ω to stabilize audio amplifier gain.	NA	REV D

AUD-250 Audio Panel, Effective Board Number 628-7505-XXX, Schematic Diagram
Figure 6-9 (Sheet A)

PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-7606-001

SYMBOL	DESCRIPTION	PART NUMBER
C1-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC DIELECTRIC 1500PF, ±10%, 50V	933-1409-020
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01 UF, +80-20%, 50V	913-3311-010
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
CR1-CR200	NOT USED	
CR201	NOT USED	
CR202	DIODE, 1S1588	353-0450-010
CR203	DIODE, 1S1588	353-0450-010
CR204	NOT USED	
CR205	DIODE, 1S1588	353-0450-010
CR206	DIODE, 1S1588	353-0450-010
CR207	DIODE, 1S1588	353-0450-010
CR208	DIODE, 1S1588	353-0450-010
DS1-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
Q1-Q100	NOT USED	
Q101	TRANSISTOR, 2SD234-Y	352-5041-010
Q102	TRANSISTOR, 2SD234-Y	352-5041-010
Q103	TRANSISTOR, 2SD234-Y	352-5041-010
Q104-Q200	NOT USED	
Q201	TRANSISTOR, 2SC372-Y	352-5044-010
Q202	TRANSISTOR, 2SC372-Y	352-5044-010

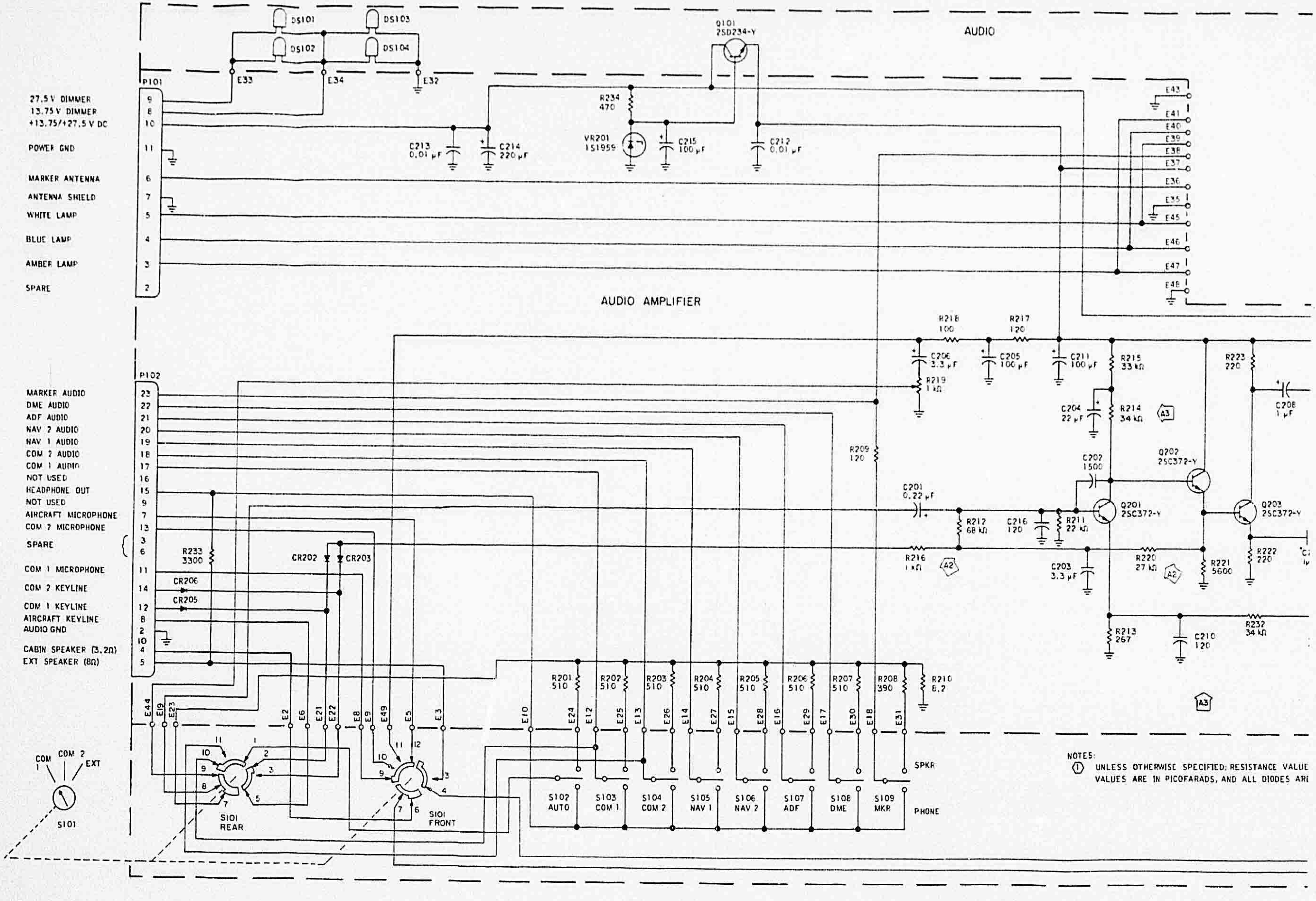
PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-7606-001

SYMBOL	DESCRIPTION	PART NUMBER
Q203	TRANSISTOR, 2SC372-Y	352-5044-010
Q204	TRANSISTOR, 2SC1166-Y	352-5048-010
Q205	TRANSISTOR, 2SC1166-Y	352-5048-010
R1-R200	NOT USED	
R201	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R202	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R203	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R204	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R205	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R206	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R207	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R208	RESISTOR, FIXED, COMPOSITION 390 OHMS, ±5%, 1/4W	745-7958-100
R209	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±5%, 1/4W	745-7958-040
R210	RESISTOR, FIXED, COMPOSITION 8200 OHMS, ±5%, 1/4W	745-7958-280
R211	RESISTOR, FIXED, COMPOSITION 22K, ±5%, 1/4W	745-7958-330
R212	RESISTOR, FIXED, COMPOSITION, 68K, 10%, 1/4W (EFF REV C)	745-7950-470
R212	RESISTOR, FIXED, COMPOSITION 47K, ±5%, 1/4W	745-7958-370
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W (EFF REV D)	745-7955-700
R213	RESISTOR, FIXED, COMPOSITION 270 OHMS, ±5%, 1/4W	745-7958-080
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R214	RESISTOR, FIXED, COMPOSITION 33K, ±5%, 1/4W	745-7958-350
R215	RESISTOR, FIXED, COMPOSITION 33K, ±5%, 1/4W	745-7958-350
R216	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W (EFF REV C)	745-7950-250
R216	RESISTOR, FIXED, COMPOSITION 2700 OHMS, ±5%, 1/4W	745-7958-220
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±5%, 1/4W	745-7958-040
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, ±5%, 1/4W	745-7958-030
R219	RESISTOR, VARIABLE 1K, 1/2W	382-0045-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W (EFF REV C)	745-7950-420
R220	RESISTOR, FIXED, COMPOSITION 47K, ±5%, 1/4W	745-7958-370
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, ±5%, 1/4W	745-7958-260
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±5%, 1/4W	745-7958-070
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±5%, 1/4W	745-7958-070
R224	RESISTOR, FIXED, COMPOSITION 39K, ±5%, 1/4W	745-7958-360
R225	RESISTOR, FIXED, COMPOSITION 39K, ±5%, 1/4W	745-7958-360
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R228	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R229	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R232	RESISTOR, FIXED, COMPOSITION 33K, ±5%, 1/4W	745-7958-350
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, ±5%, 1/4W	745-7958-230
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
S1-S100	NOT USED	

PARTS LIST
AUD-250 AUDIO PANEL
ASSEMBLY 628-7606-001

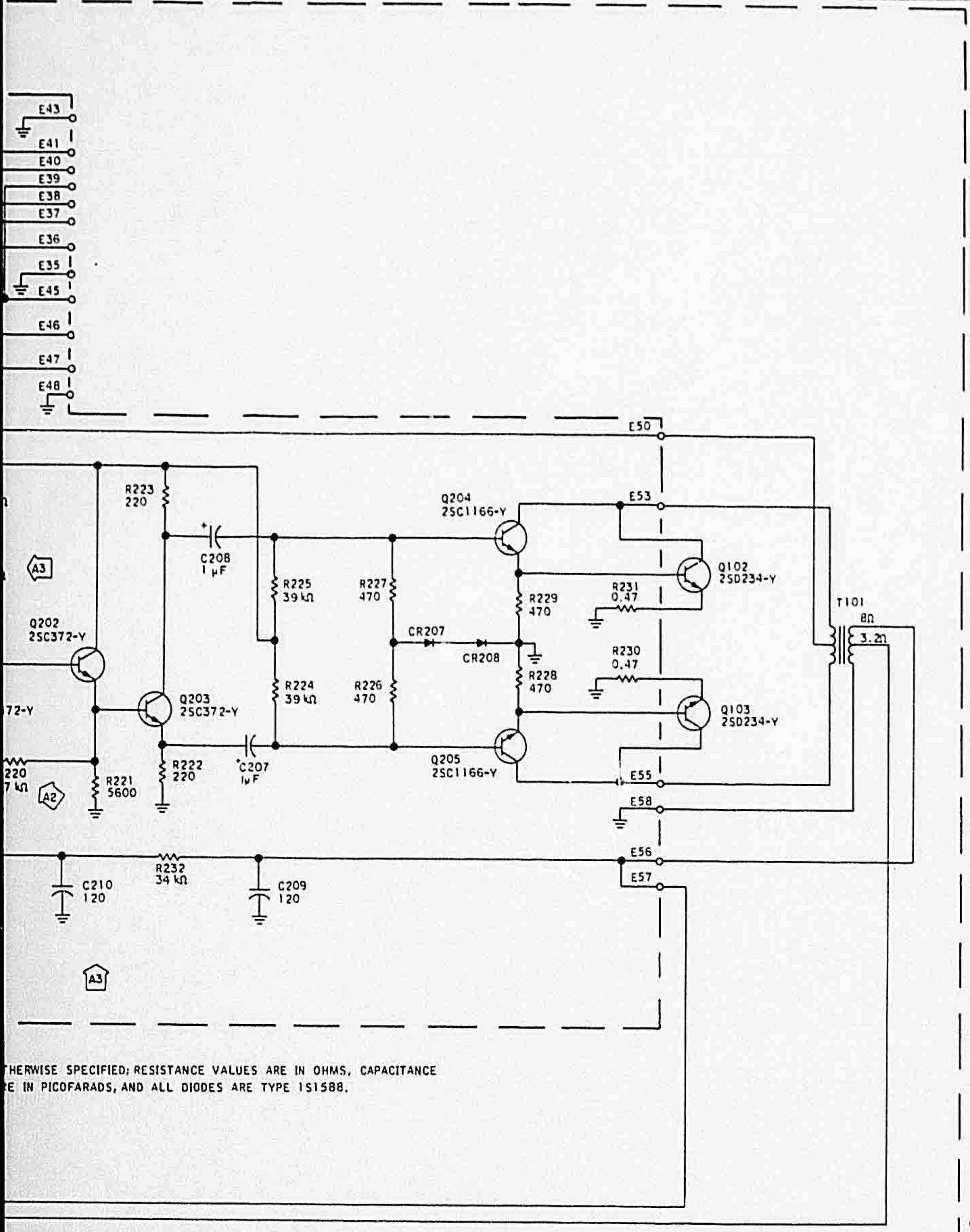
SYMBOL	DESCRIPTION	PART NUMBER
S101	SWITCH, WAFER, 3 POS	259-1024-020
S102	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S103	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S104	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S105	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S106	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S107	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S108	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR 628-7373-001/ 266-5417-090
S109	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
T1-T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
VR1-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130

*PART NUMBERS ARE SWITCH/LEVER CAP.



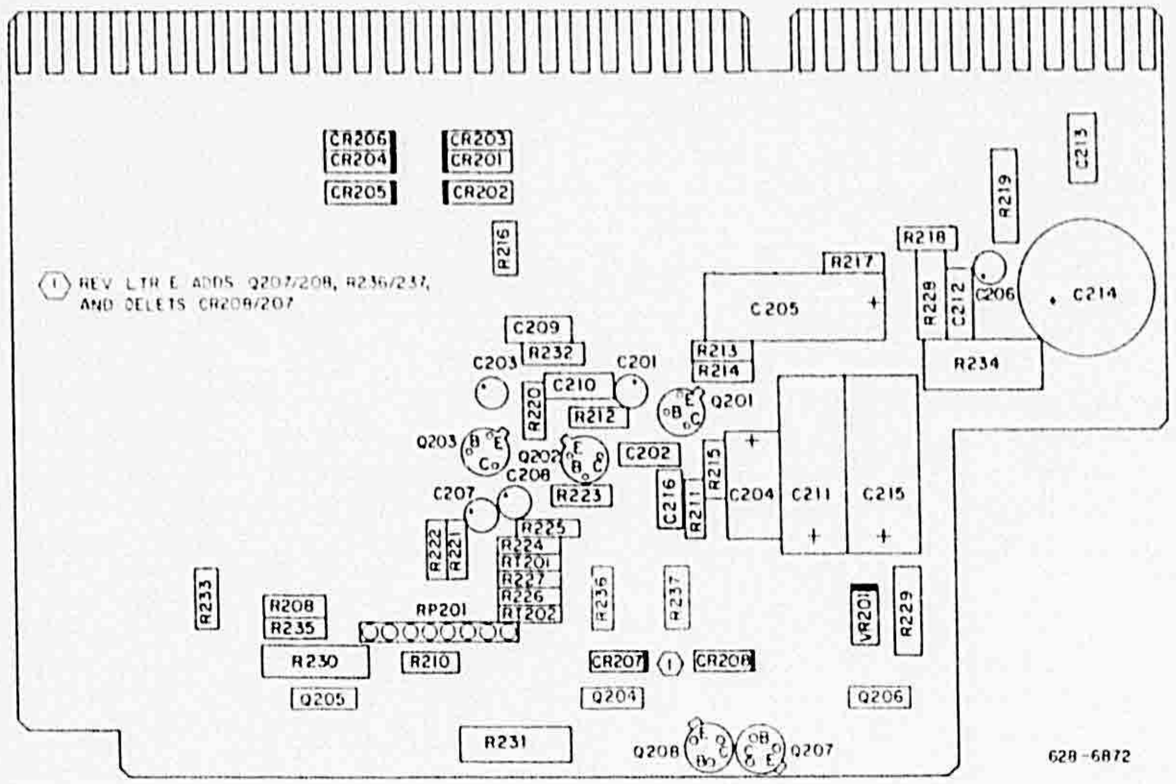
SEE BLOW-UP FICHE NO. CRL103 - ITEM C

SEE BLOW-UP FICHE NO. CRL103 - ITEM D

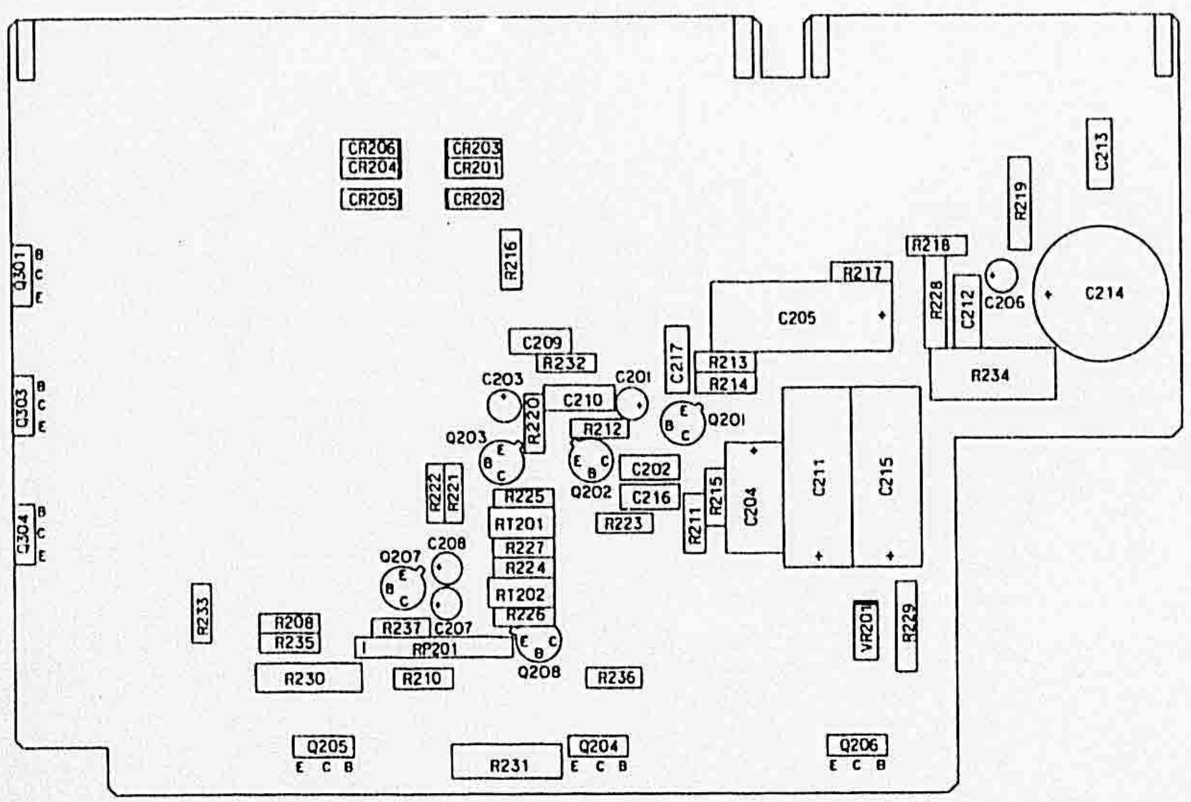


THERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE
E IN PICOFARADS, AND ALL DIODES ARE TYPE 1S1588.

AUD-250 Audio Panel, Effective Board Number 628-7505-XXX, Schematic Diagram
Figure 6-9



AUD-250H Audio Panel, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-10



628-7661

AUD-250H Audio Panel, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-11

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Changed value of R213 from 267 to 249 Ω, R226 and R277 from 470 Ω to 1 kΩ; changed R224 and R225 from 22 kΩ to test select components; added RT201 and RT202. Changes prevent thermal runaway in 27.5-V installations.	SB 1	REV D
2	Added Q207, Q208, R236, and R237. Changed Q204 and Q205 from MJE800 to MJE521. Changes prevent thermal runaway. Refer to partial schematic on apron for diagram of affected area prior to revision E.	NA	REV E
C	Added C217 to prevent no-load oscillation.	NA	REV H
D	Changed Q204 and Q205 from MJE 521 to 2N5191 to improve reliability.	NA	REV W
E	Changed CR201 and CR204 from 1N4454 to 1N4003 to improve reliability.	NA	REV L

AUD-250H Audio Panel, Effective Board Number 628-6114-XXX, Schematic Diagram
Figure 6-12 (Sheet A)

PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-6113-003

SYMBOL	DESCRIPTION	PART NUMBER
C1-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, POLYESTER DIEL 1500PF, ±5%, 100V	933-1404-120
C202	CAPACITOR, FIXED, PLASTIC, DIELECTRIC 1500PF, ±5%, 100V	933-1404-120
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CER DIEL 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CER DIEL 120PF, ±5%, 50V	931-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CER DIEL .01 UF, +80-20%, 50V	913-3298-130
C213	CAPACITOR, FIXED, CER DIEL, 0.1UF, +80-20%, 50V	913-3298-130
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CER DIEL 120PF, ±5%, 50V	913-3308-210
C217	CAPACITOR, FXD, CER DIEL, 680PF, 20%, 1000V (EFF REV H)	913-1194-000
CR1-CR200	NOT USED	
CR201	DIODE, 1N4003 (EFF REV L)	353-6442-030
CR201	DIODE, 1N4454	353-3741-010
CR202	DIODE, 1N4454	353-3741-010
CR203	DIODE, 1N4454	353-3741-010
CR204	DIODE, 1N4003 (EFF REV L)	353-6442-030
CR204	DIODE, 1N4454	353-3741-010
CR205	DIODE, 1N4454	353-3741-010
CR206	DIODE, 1N4454	353-3741-010
CR207	NOT USED (EFF REV E)	
CR207	DIODE, 1N4454	353-3741-010
CR208	NOT USED (EFF REV E)	
CR207	DIODE, 1N4454	353-3741-010
CR208	DIODE, 1N4454	353-3741-010
DS1-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
Q1-Q200	NOT USED	

PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-6113-003

SYMBOL	DESCRIPTION	PART NUMBER
Q201	TRANSISTOR, 2N2222	352-5021-010
Q202	TRANSISTOR, 2N2222	352-5021-010
Q203	TRANSISTOR, 2N2222	352-5021-010
Q204	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q204	TRANSISTOR, MJE521 (EFF REV R)	352-5064-010
Q204	TRANSISTOR, MJE521 (EFF REV E)	352-5064-010
Q204	TRANSISTOR, MJE800	352-5028-010
Q205	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q205	TRANSISTOR, MJE521 (EFF REV R)	352-5064-010
Q205	TRANSISTOR, MJE521 (EFF REV E)	352-5064-010
Q205	TRANSISTOR, MJE 800	352-5028-010
Q206	TRANSISTOR, MJE 182	352-5011-010
Q207	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
Q208	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
R1-R207	NOT USED	
R208	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R209	NOT USED	
R210	RESISTOR, FIXED, COMPOSITION 8.2 OHMS, ±5%, 1/4W	745-7958-010
R211	RESISTOR, FIXED, COMPOSITION 22K, 10%, 1/4W	745-7950-410
R212	RESISTOR, FIXED, COMPOSITION 68K, 10%, 1/4W	745-7950-470
R213	RESISTOR, FIXED, FILM, 249 OHMS, 1%, 1/8W (EFF REV D; SB 1)	745-7955-670
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W	745-7955-700
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R215	RESISTOR, FIXED, COMPOSITION 33K, ±10%, 1/4W	745-7950-430
R216	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±10%, 1/4W	745-7950-140
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, ±10%, 1/4W	745-7950-130
R219	RESISTOR, VARIABLE 1K, ±30%, 0.1W	382-0500-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, ±10%, 1/4W	745-7950-340
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R224	TEST SELECT VALUES (EFF REV G)	
R224	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R224	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R224	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R224	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R224	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R224	TEST SELECT (EFF REV D; SB 1)	
R224	RESISTOR, FIXED, COMPOSITION 22K ±10%, 1/4W	745-7950-410
R225	TEST SELECT VALUES (EFF REV G)	
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R225	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440

Revised 9 June 1982

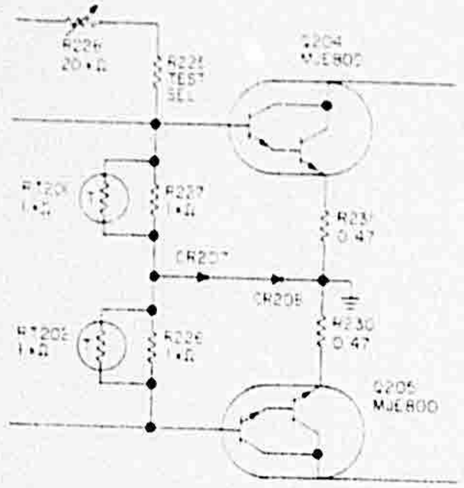
PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-6113-003

SYMBOL	DESCRIPTION	PART NUMBER
R225	RESISTOR, FIXED, COMPOSITION 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FIXED, COMPOSITION 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FIXED, COMPOSITION 22K, 10%, 1/4W	745-7950-410
R226	RESISTOR, FIXED, COMPOSITION 1K ±10%, 1/4W (EFF REV D; SB 1)	745-7950-250
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R228	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R229	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, ±10%, 1/4W	745-7950-310
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
R235	RESISTOR, FIXED, COMPOSITION, 510 OHMS ±5%, 1/8W	745-7958-130
R236	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
R237	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
RP1-RP200	NOT USED	
RP201	RESISTOR NETWORK, 500 OHMS ±5%, 1/8W	350-4000-080
RT1-RT200	NOT USED	
RT201	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 1)	714-3255-010
RT202	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 1)	714-3255-010
S1-S100	NOT USED	
S101	SWITCH, WAFER, 3 POS	259-1024-070
S101	SWITCH, WAFER, 3 POS	259-1024-100
S102	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S103	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S104	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S105	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140

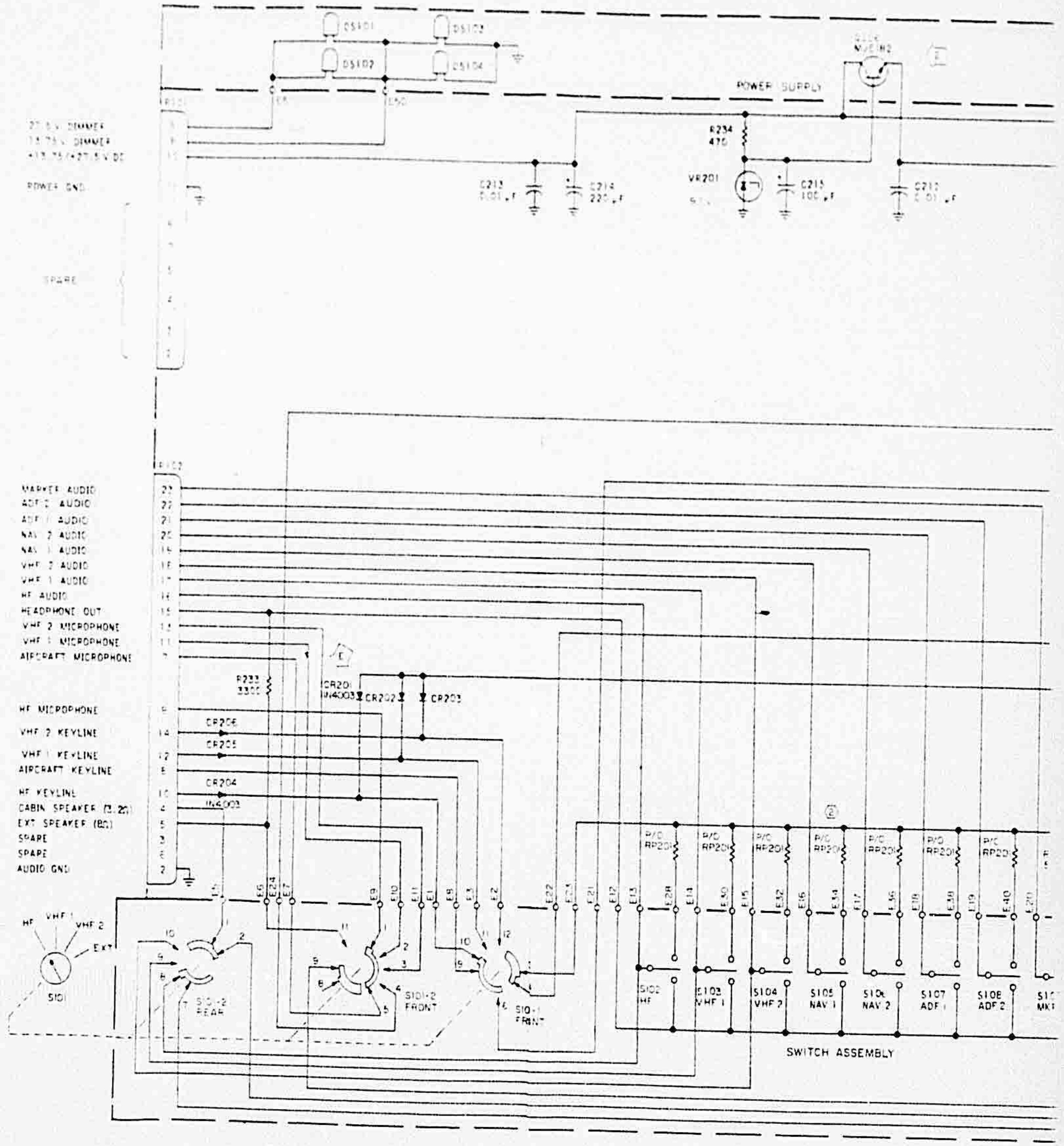
PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-6113-003

SYMBOL	DESCRIPTION	PART NUMBER
S106	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S107	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S108	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S109	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 *266-5417-130/ 266-5417-140
S110	SWITCH, 3 POSITION	259-1024-120/ 259-1024-130/ 259-1024-140
T1-T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
VR1-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130

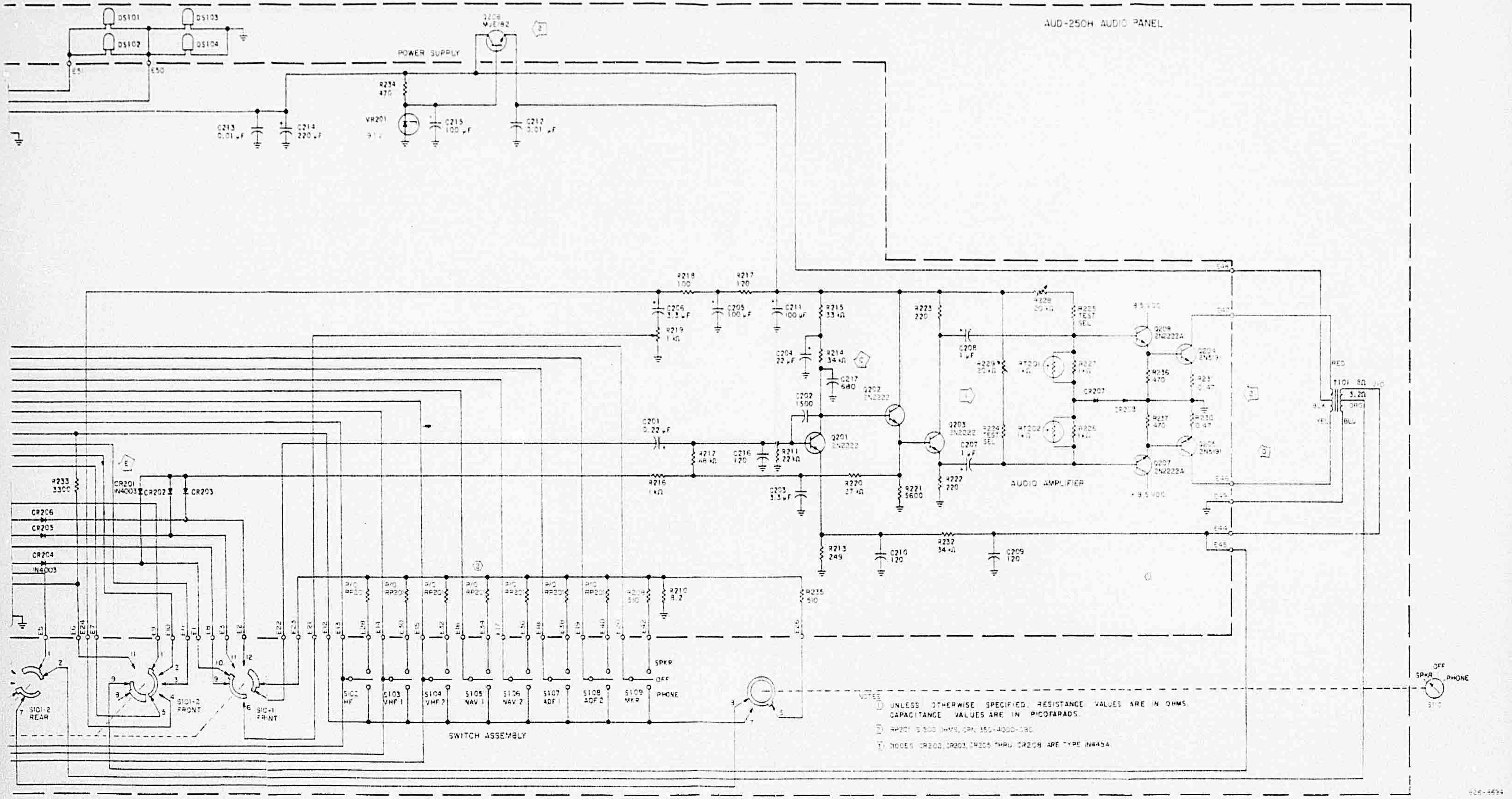
*PART NUMBERS ARE SWITCH/LEVER CAP.



REVISIONS A THROUGH D

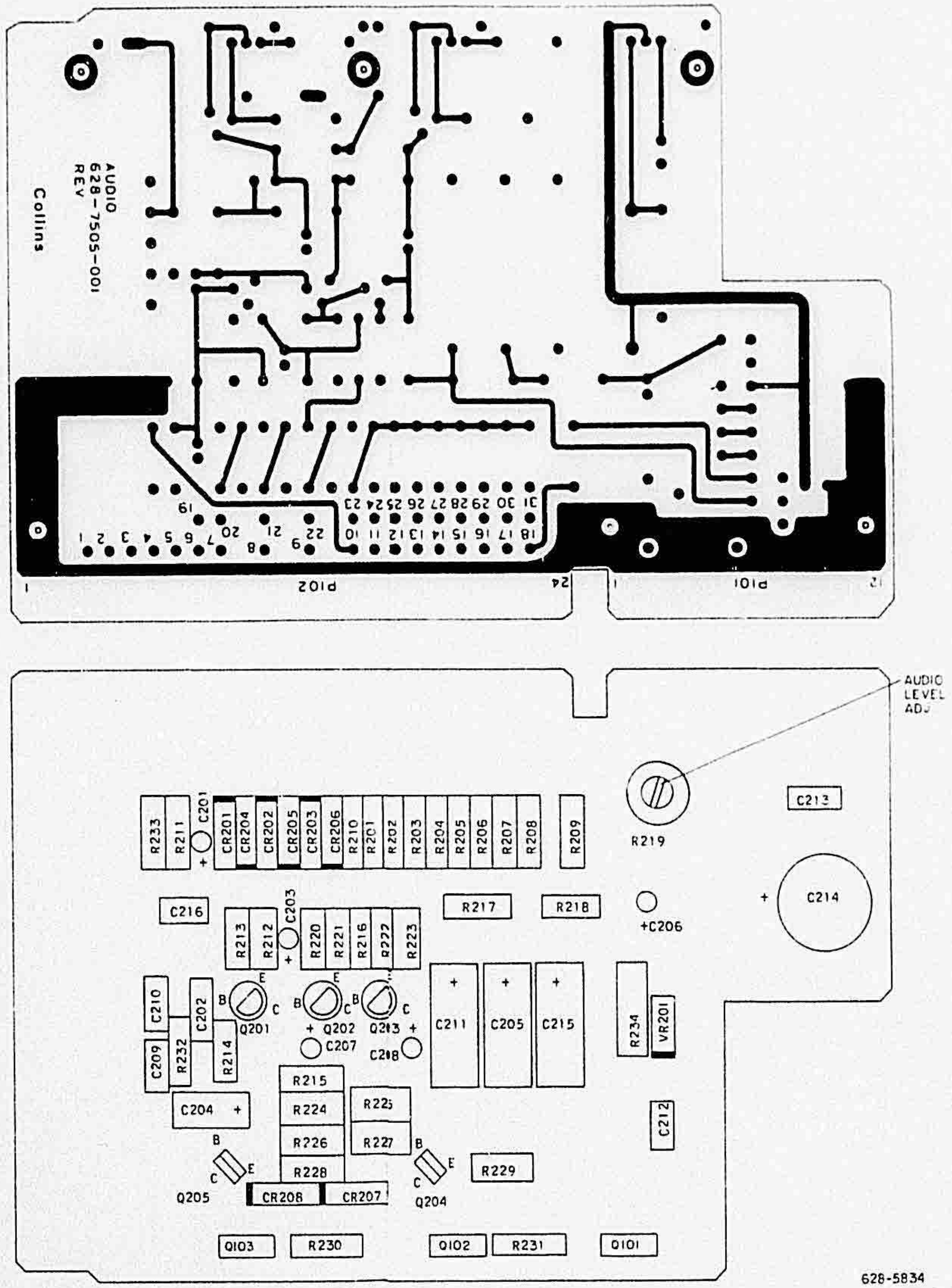


SEE BLOW–UP FICHE NO. CRL103 - ITEM G



AUD-250H Audio Panel, Effective Board Number 628-6111-XXX, Schematic Diagram
Figure 6-11

SEE BLOW-UP FICHE NO. CRL103 - ITEM 6



NOTE: DIODES CR201 AND CR204 ARE USED IN AMR-350H AND AUD-250H UNITS ONLY.

628-5834
TP4-3110-014

AUD-250H Audio Panel, Effective Board Number 628-7505-XXX, Component Location Diagram
Figure 6-13

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Rearranged graphic configuration of switch S101 to show actual switching sequence.	NA	NA
2	Added switch S110 and resistor R101 to provide AUTO function.	NA	All models
3	Resistors R212 and R220 were 47 kΩ, R216 was 2700 Ω. Values changed to ensure muting with diode in aircraft key line.	NA	REV C
4	Changed R214 and R232 from 33 to 34.0 kΩ and R213 from 270 to 267 Ω to stabilize audio amplifier gain.	NA	REV D

AUD-250H Audio Panel, Effective Board Number 628-7505-XXX, Schematic Diagram
Figure 6-14 (Sheet A)

PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-7606-002

SYMBOL	DESCRIPTION	PART NUMBER
C1-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC DIELECTRIC 1500PF, ±10%, 50V	933-1409-020
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
[illegible]	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
CR1-CR200	NOT USED	
CR201	DIODE, 1S1588	353-0450-010
CR202	DIODE, 1S1588	353-0450-010
CR203	DIODE, 1S1588	353-0450-010
CR204	DIODE, 1S1588	353-0450-010
CR205	DIODE, 1S1588	353-0450-010
CR206	DIODE, 1S1588	353-0450-010
CR207	DIODE, 1S1588	353-0450-010
CR208	DIODE, 1S1588	353-0450-010
DS1-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
Q1-Q100	NOT USED	
Q101	TRANSISTOR, 2SD234-Y	352-5041-010
Q102	TRANSISTOR, 2SD234-Y	352-5041-010
Q103	TRANSISTOR, 2SD234-Y	352-5041-010
Q104-Q200	NOT USED	
Q201	TRANSISTOR, 2SC372-Y	352-5044-010
Q202	TRANSISTOR, 2SC372-Y	352-5044-010

PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-7606-002

SYMBOL	DESCRIPTION	PART NUMBER
Q203	TRANSISTOR, 2SC372-Y	352-5044-010
Q204	TRANSISTOR, 2SC1166-Y	352-5048-010
Q205	TRANSISTOR, 2SC1166-Y	352-5048-010
R1-R100	NOT USED	
R101	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R102-R200	NOT USED	
R201	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R202	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R203	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R204	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R205	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R206	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R207	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R208	RESISTOR, FIXED, COMPOSITION 390 OHMS, ±5%, 1/4W	745-7958-100
R209	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±5%, 1/4W	745-7958-040
R210	RESISTOR, FIXED, COMPOSITION 8200 OHMS, ±5%, 1/4W	745-7958-280
R211	RESISTOR, FIXED, COMPOSITION 22K, ±5%, 1/4W	745-7958-330
R212	RESISTOR, FIXED, COMPOSITION 68K, 10%, 1/4W (EFF REV C)	745-7950-470
R212	RESISTOR, FIXED, COMPOSITION 47K, ±5%, 1/4W	745-7958-370
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W (EFF REV D)	745-7955-700
R213	RESISTOR, FIXED, COMPOSITION 270 OHMS, ±5%, 1/4W	745-7958-080
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R214	RESISTOR, FIXED, COMPOSITION 33K, ±5%, 1/4W	745-7958-350
R215	RESISTOR, FIXED, COMPOSITION 33K, ±5%, 1/4W	745-7958-350
R216	RESISTOR, FIXED, COMPOSITION 1K, 10%, 1/4W (EFF REV C)	745-7950-250
R216	RESISTOR, FIXED, COMPOSITION 2700 OHMS, ±5%, 1/4W	745-7958-220
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±5%, 1/4W	745-7958-040
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, ±5%, 1/4W	745-7958-030
R219	RESISTOR, VARIABLE 1K, 1/2W	382-0045-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W (EFF REV C)	745-7950-420
R220	RESISTOR, FIXED, COMPOSITION 47K, ±5%, 1/4W	745-7958-370
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, ±5%, 1/4W	745-7958-260
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±5%, 1/4W	745-7958-070
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±5%, 1/4W	745-7958-070
R224	RESISTOR, FIXED, COMPOSITION 39K, ±5%, 1/4W	745-7958-360
R225	RESISTOR, FIXED, COMPOSITION 39K, ±5%, 1/4W	745-7958-360
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R228	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R229	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±5%, 1/4W	745-7958-120
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020

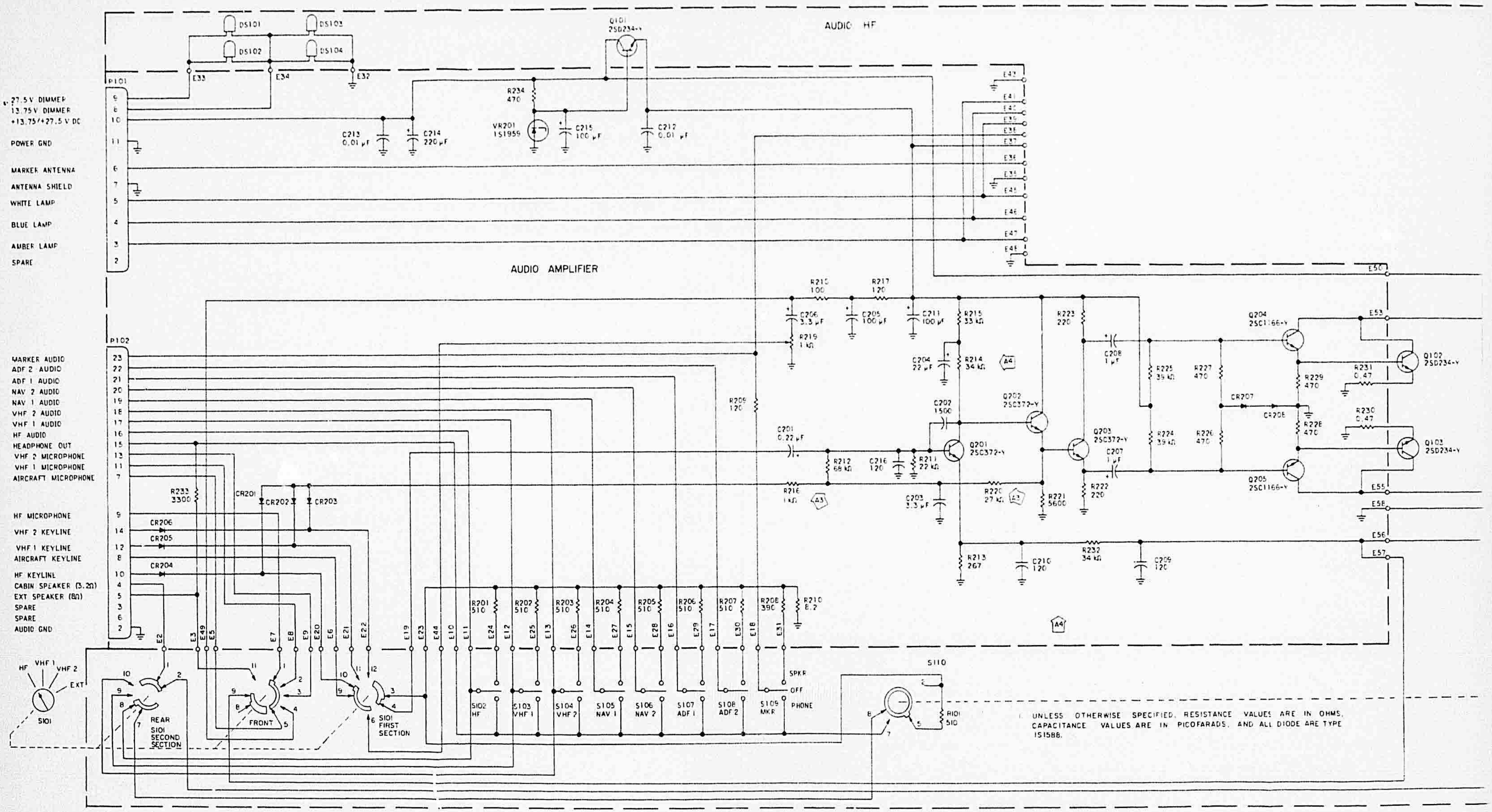
PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-7606-002

SYMBOL	DESCRIPTION	PART NUMBER
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R232	RESISTOR, FIXED, COMPOSITION 33K, ±5%, 1/4W	745-7958-350
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, ±5%, 1/4W	745-7958-230
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
S1-S100	NOT USED	
S101	SWITCH, WAFER, 3 POS	259-1024-030
S102	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S103	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S104	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S105	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S106	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S107	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S108	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S109	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090

PARTS LIST
AUD-250H AUDIO PANEL
ASSEMBLY 628-7606-002

SYMBOL	DESCRIPTION	PART NUMBER
S110	SWITCH, WAFER, 3 POS	259-1024-040
T1-T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
VR1-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130

*PART NUMBERS ARE SWITCH/LEVER CAP.

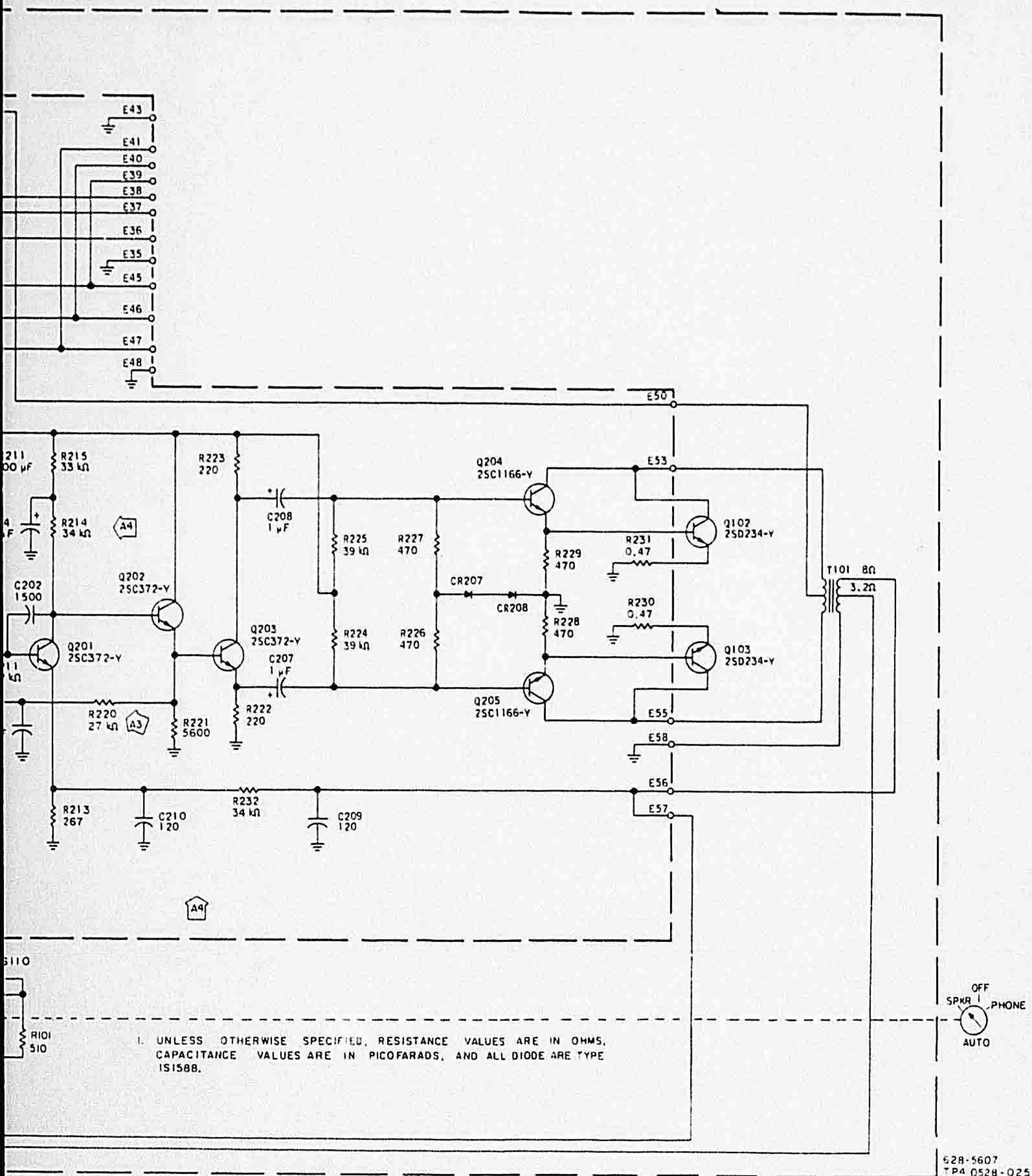


AUD-250H Audio Pan[el]
628-7505-XXX.
Fig

Revised 9 June 1982

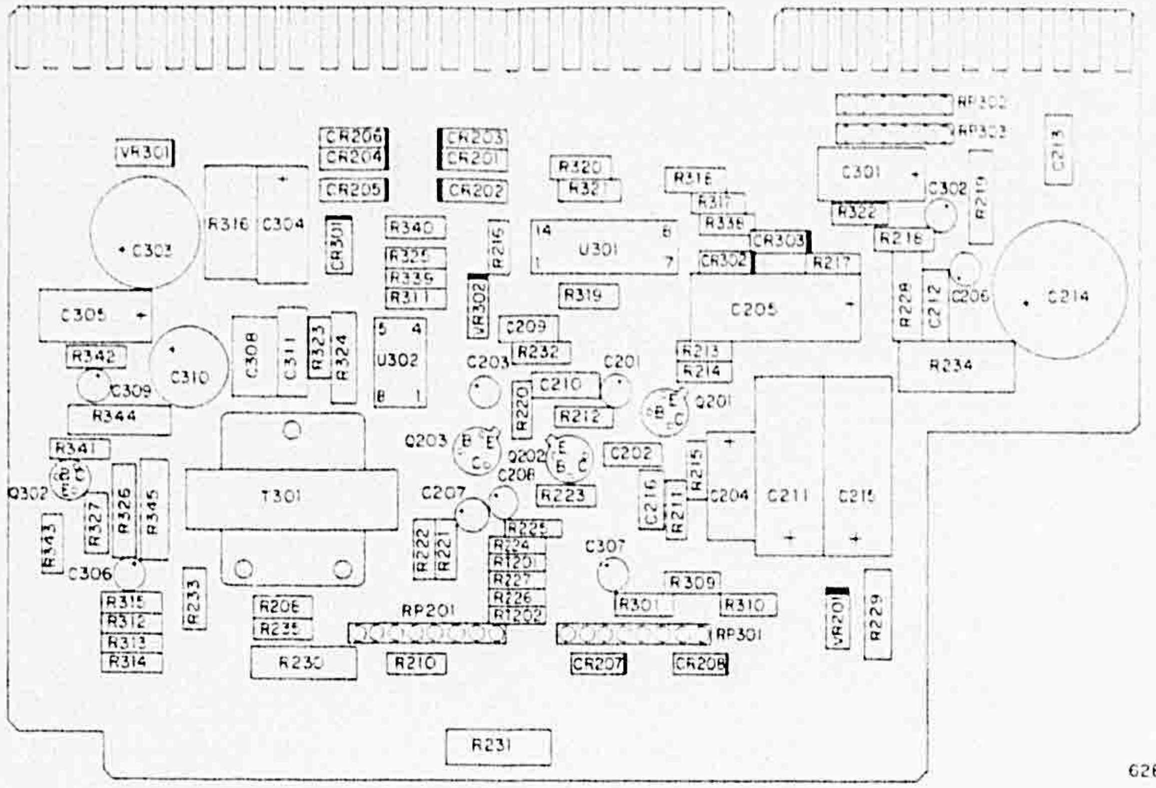
SEE BLOW–UP FICHE NO. CRL103 - ITEM K

SEE BLOW–UP FICHE NO. CRL103 - ITEM L



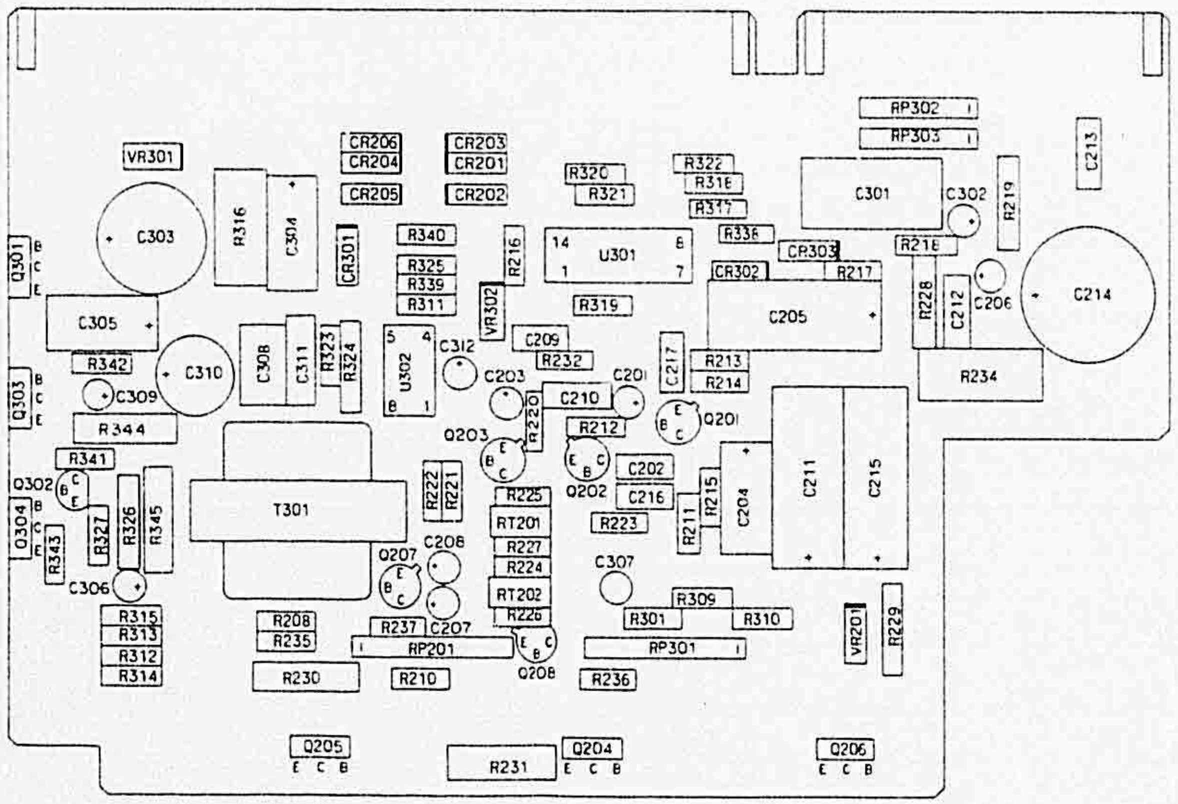
1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL DIODE ARE TYPE 1S1588.

AUD-250H Audio Panel, Effective Board Number 628-7505-XXX, Schematic Diagram
Figure 6-12



628-6501

AUD-251H Audio Panel, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-15



628-7662

AUD-251H Audio Panel, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-16

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Corrected pin numbers on U301, added terminal E6, and changed E24 to E22.	NA	NA
2	Changed value of R213 from 267 to 249 Ω, R226 and R227 from 470 Ω to 1 kΩ; changed R224 and R225 from 22 kΩ to test select components; added RT201 and RT202. Changes prevent thermal runaway in 27.5-V installations.	SB 1	REV D
3	Added Q207, Q208, R236, and R237. Changed Q204 and Q205 from MJE800 to MJE521. Changes prevent thermal runaway. Refer to partial schematic on apron for diagram of affected area prior to revision F.	NA	REV F
D	Added C217 to prevent no-load oscillation.	NA	REV H
E	Changed Q204 and Q205 from MJE 521 to 2N5191 to improve reliability.	NA	REV W
F	Changed CR201 and CR202 from 1N4454 to 1N4003 to improve reliability.	NA	REV L
G	Changed C301 from 22 to 100 μF to improve isolation between intercom inputs.	SB 3R1	REV T

AUD-251H Audio Panel (CPN 628-6113-001), Schematic Diagram
Figure 6-17 (Sheet A)

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-001

SYMBOL	DESCRIPTION	PART NUMBER
C201	CAPACITOR, FIXED, TANTALUM, 0.22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 1500PF, ±5%, 100V	933-1404-120
C203	CAPACITOR, FIXED, TANTALUM, 3.3UF, ±20%, 6V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100%, 20V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM, 3.3UF, ±20%, 6V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, -20/+80%, 50V	913-3298-130
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, -20/+80%, 50V	913-3298-130
C214	CAPACITOR, FIXED, ELECTROLYTIC, 220UF, -20/+100%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 120PF, ±5%, 50V	913-3308-210
C217	CAPACITOR, FXD, CER DIEL, 680PF, 20%, 1000V (EFF REV H)	913-1194-000
C218 thru C300	NOT USED	
C301	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V (EFF REV T; SB 3 R1)	183-1471-120
C301	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100% 20V	183-1471-180
C302	CAPACITOR, FIXED, CER DIEL, 1UF, ±20%, 50V (EFF REV M; SB 4)	913-3270-270
C302	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C303	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 50V	183-1471-220
C304	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100%, 20V	183-1471-180
C305	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100%, 20V	183-1471-180
C306	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C307	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C308	CAPACITOR, FIXED, MICA DIELECTRIC, 270PF, ±5%, 300V	912-2099-400

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-001

SYMBOL	DESCRIPTION	PART NUMBER
C309	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C310	CAPACITOR, FIXED, ELECTROLYTIC, 220UF, -20/+100%, 10V	183-1471-210
C311	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.047UF, -20/+80%, 25V	913-3298-050
C312	CAPACITOR, FIXED, TANTALUM, 1UF, 20%, 35V	184-9113-030
CR201	DIODE, 1N4003 (EFF REV L)	353-6442-010
CR201	DIODE, 1N4454	353-3741-010
CR202	DIODE, 1N4454	353-3741-010
CR203	DIODE, 1N4454	353-3741-010
CR204	DIODE, 1N4003 (EFF REV L)	353-6442-010
CR204	DIODE, 1N4454	353-3741-010
CR205	DIODE, 1N4454	353-3741-010
CR206	DIODE, 1N4454	353-3741-010
CR207	DIODE, 1N4454	353-3741-010
CR208	DIODE, 1N4454	353-3741-010
CR209 thru CR300	NOT USED	
CR301	DIODE, 1N4454	353-3741-010
CR302	DIODE, 1N4454	353-3741-010
CR303	DIODE, 1N4454	353-3741-010
DS1 thru DS100	NOT USED	
DS101	LAMP, 14V, 65MA	262-1398-080
DS102	LAMP, 14V, 65MA	262-1398-080
DS103	LAMP, 14V, 65MA	262-1398-080
DS104	LAMP, 14V, 65MA	262-1398-080
Q1 thru Q200	NOT USED	
Q201	TRANSISTOR, 2N2222	352-5021-010
Q202	TRANSISTOR, 2N2222	352-5021-010
Q203	TRANSISTOR, 2N2222	352-5021-010
Q204	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q204	TRANSISTOR, MJE 521 (EFF REV F)	352-5064-010
Q204	TRANSISTOR, MJE 800	352-5028-010
Q205	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q205	TRANSISTOR, MJE 521 (EFF REV F)	352-5064-010
Q205	TRANSISTOR, MJE 800	352-5028-010
Q206	TRANSISTOR, MJE 182	352-5011-010
Q207	TRANSISTOR, 2N2222 (EFF REV F)	352-5021-010
Q208	TRANSISTOR, 2N2222 (EFF REV F)	352-5021-010
Q209 thru Q300	NOT USED	
Q301	TRANSISTOR, MJE 182	352-5011-010
Q302	TRANSISTOR, MPSA 14	352-5035-010
Q303	TRANSISTOR, MJE 800	352-5028-010

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-001

SYMBOL	DESCRIPTION	PART NUMBER
Q304	TRANSISTOR, MJE 700	352-5028-020
R1 thru R207	NOT USED	
R208	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R209	NOT USED	
R210	RESISTOR, FIXED, COMPOSITION, 8.2 OHMS, ±5%, 1/4W	745-7958-010
R211	RESISTOR, FIXED, COMPOSITION, 22K, ±10%, 1/4W	745-7950-410
R212	RESISTOR, FIXED, COMPOSITION, 68K, ±10%, 1/4W	745-7950-470
R213	RESISTOR, FXD, FILM, 249 OHMS, 1%, 1/8W (EFF REV D; SB 1)	745-7955-670
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W	745-7955-700
R214	RESISTOR, FIXED, FILM, 34K, ±1%, 1/8W	745-7957-740
R215	RESISTOR, FIXED, COMPOSITION, 33K, ±10%, 1/4W	745-7950-430
R216	RESISTOR, FIXED, COMPOSITION, 1K, ±10%, 1/4W	745-7950-250
R217	RESISTOR, FIXED, COMPOSITION, 120 OHMS, ±10%, 1/4W	745-7950-140
R218	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±10%, 1/4W	745-7950-130
R219	RESISTOR, VARIABLE, SINGLE TURN, 1K, ±30%, 0.1W	382-0500-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, ±10%, 1/4W	745-7950-420
R221	RESISTOR, FIXED, COMPOSITION, 5.6K, ±10%, 1/4W	745-7950-340
R222	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±10%, 1/4W	745-7950-170
R223	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±10%, 1/4W	745-7950-170
R224	TEST SELECT VALUES (EFF REV G)	
R224	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R224	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R224	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R224	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R224	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R224	TEST SELECT (EFF REF D; SB 1)	
R224	RESISTOR, FIXED, COMPOSITION, 22K, ±10%, 1/4W	745-7950-410
R225	TEST SELECT VALUES (EFF REV G)	
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R225	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R225	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FIXED, COMPOSITION, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FIXED, COMPOSITION, 22K, 10%, 1/4W	745-7950-410
R226	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W (EFF REV D; SB 1)	745-7950-250
R226	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1/4W	745-7950-210
R227	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1/4W	745-7950-210
R228	RESISTOR, VARIABLE, SINGLE TURN, 20K, ±30%, 0.1W	382-0500-040
R229	RESISTOR, VARIABLE, SINGLE TURN, 20K, ±30%, 0.1W	382-0500-040
R230	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34K, ±1%, 1/8W	745-7957-740

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-001

SYMBOL	DESCRIPTION	PART NUMBER
R233	NOT USED	
R234	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1W	745-7952-210
R235	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R236	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV F)	745-7950-210
R237	RESISTOR, FXD, CMPSN, 470 OHMS, 10%, 1/4W (EFF REF F)	745-7950-210
R238 thru R300	NOT USED	
R301	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R302 thru R308	NOT USED	
R309	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R310	RESISTOR, FIXED, COMPOSITION, 8.2 OHMS, ±5%, 1/4W	745-7958-010
R311	RESISTOR, FIXED, COMPOSITION, 3.9K, ±10%, 1/4W	745-7950-320
R312	RESISTOR, FIXED, COMPOSITION, 1.5K, ±10%, 1/4W	745-7950-270
R313	RESISTOR, FIXED, COMPOSITION, 2.2K, ±10%, 1/4W	745-7950-290
R314	RESISTOR, FIXED, COMPOSITION, 39 OHMS, ±10%, 1/4W	745-7950-080
R315	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R316	RESISTOR, FIXED, WIREWOUND, 180 OHMS, ±5%, 3W	745-7953-060
R317	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R318	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1/4W	745-7950-210
R319	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R320	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R321	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R322	RESISTOR, FIXED, COMPOSITION, 47 OHMS, ±10%, 1/4W	745-7950-090
R323	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R324	RESISTOR, VARIABLE, SINGLE TURN, 200K, ±30%, 0.1W	382-0500-050
R325	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R326	RESISTOR, VARIABLE, SINGLE TURN, 20K, ±30%, 0.1W	382-0500-040
R327	RESISTOR, FIXED, COMPOSITION, 47K, ±10%, 1/4W	745-7950-450
R328 thru R337	NOT USED	
R338	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R339	RESISTOR, FIXED, COMPOSITION, 1K, ±10%, 1/4W	745-7950-250
R340	RESISTOR, FIXED, COMPOSITION, 3.9K, ±10%, 1/4W	745-7950-320
R341	RESISTOR, FIXED, COMPOSITION, 47K, ±10%, 1/4W	745-7950-450
R342	RESISTOR, FIXED, COMPOSITION, 2.2K, ±10%, 1/4W	745-7950-290
R343	RESISTOR, FIXED, COMPOSITION, 2.2K, ±10%, 1/4W	745-7950-290
R344	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
R345	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
RP1 thru RP200	NOT USED	
RP201	RESISTOR, NETWORK, SINGLE IN-LINE, 8 PIN, 500 OHMS, ±5%, 1/8W	350-4000-080

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-001

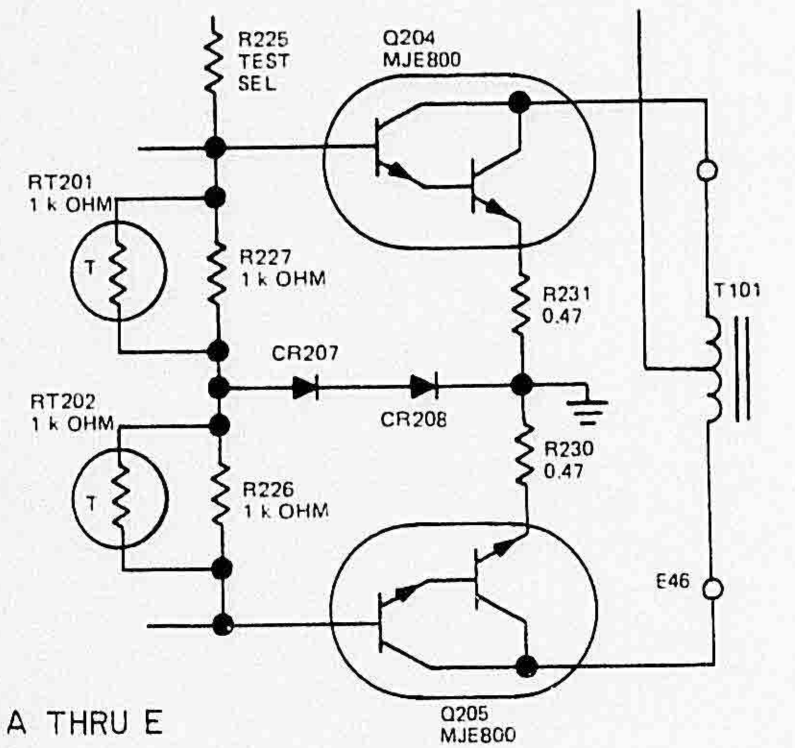
SYMBOL	DESCRIPTION	PART NUMBER
RP202 thru RP300	NOT USED	
RP301	RESISTOR, NETWORK, SINGLE IN-LINE, 8 PIN, 500 OHMS, ±5%, 1/8W	350-4000-080
RP302	RESISTOR, NETWORK, SINGLE IN-LINE, 6 PIN, 47K, ±10%, 1/8W	350-4000-060
RP303	RESISTOR, NETWORK, SINGLE IN-LINE, 6 PIN, 330 OHMS, ±10%	350-4000-070
RT1-RT200	NOT USED	
RT201	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 1)	714-3255-010
RT202	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 1)	714-3255-010
S1 thru S100	NOT USED	
S101	SWITCH, 4 POSITION WAFER, 2 SECTION	259-1024-070
S102	SWITCH, TOGGLE/CAP, SPDT	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S103	SWITCH, TOGGLE/CAP, SPDT	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S104	SWITCH, TOGGLE/CAP, SPDT	*628-7313-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S105	SWITCH, TOGGLE/CAP, SPDT	*628-7313-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S106	SWITCH, TOGGLE/CAP, SPDT	*628-7313-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140

*PART NUMBERS ARE SWITCH/LEVER CAP.

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-001

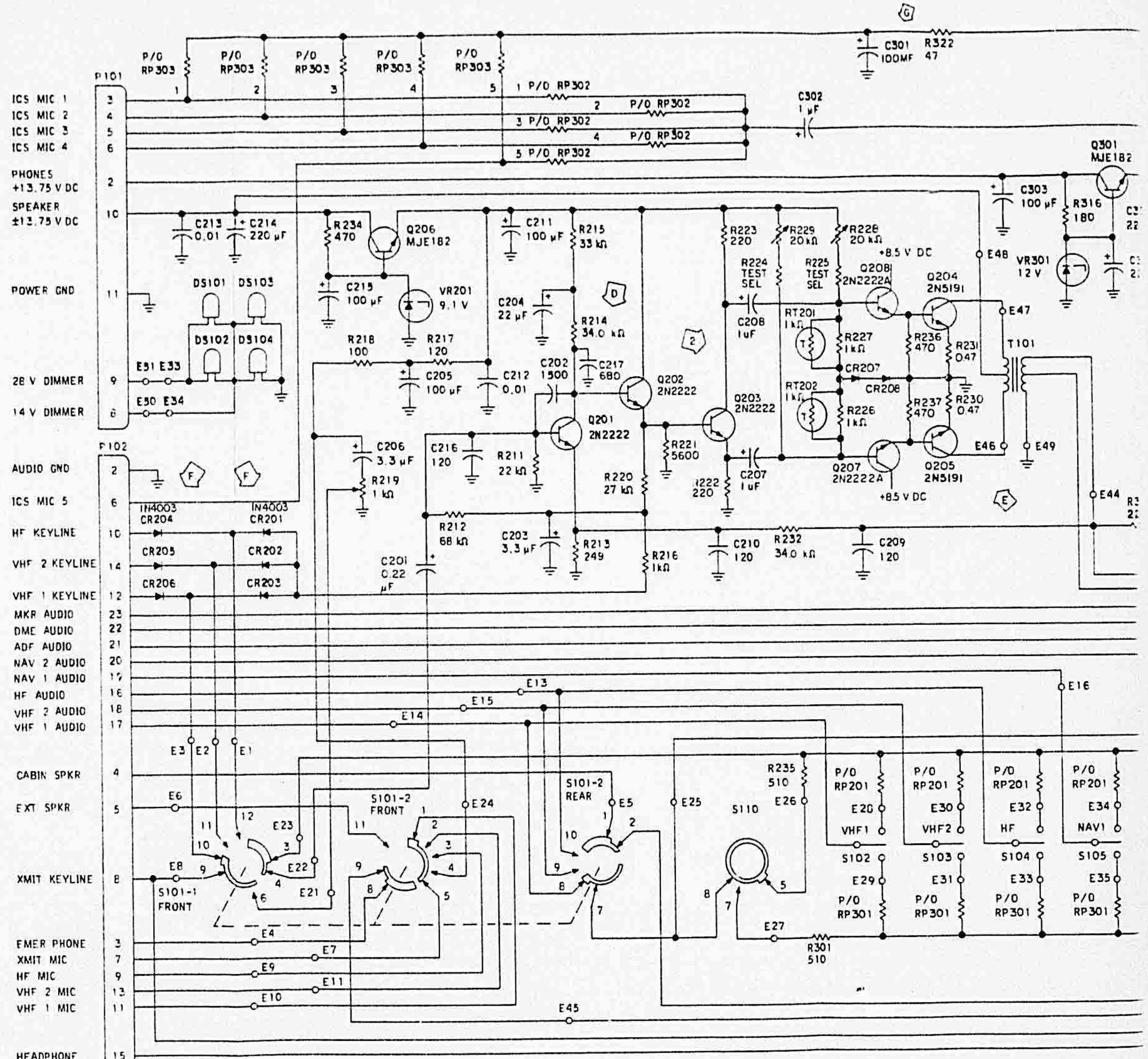
SYMBOL	DESCRIPTION	PART NUMBER
S107	SWITCH, TOGGLE/CAP, SPDT	*628-7313-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S108	SWITCH, TOGGLE/CAP, SPDT	*628-7313-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S109	SWITCH, TOGGLE/CAP, SPDT	*628-7313-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S110	SWITCH, 3 POSITION WAFER	259-1024-120
T1 thru T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
T102 thru T300	NOT USED	
T301	TRANSFORMER, HEADPHONE	667-0279-010
U1 thru U300	NOT USED	
U301	COMPLEMENTARY MOS QUAD BILATERAL SWITCH, 4016	351-8260-010
U302	OPERATIONAL AMPLIFIER, 1741	351-1156-010
VR1 thru VR200	NOT USED	
VR201	ZENER DIODE, 9.1V	353-3737-130
VR202 thru VR300	NOT USED	
VR301	ZENER DIODE, 12V	353-3738-090
VR302	ZENER DIODE, 5.6V	353-3737-050

*PART NUMBERS ARE SWITCH/LEVER CAP.



REVISIONS A THRU E

628-7597

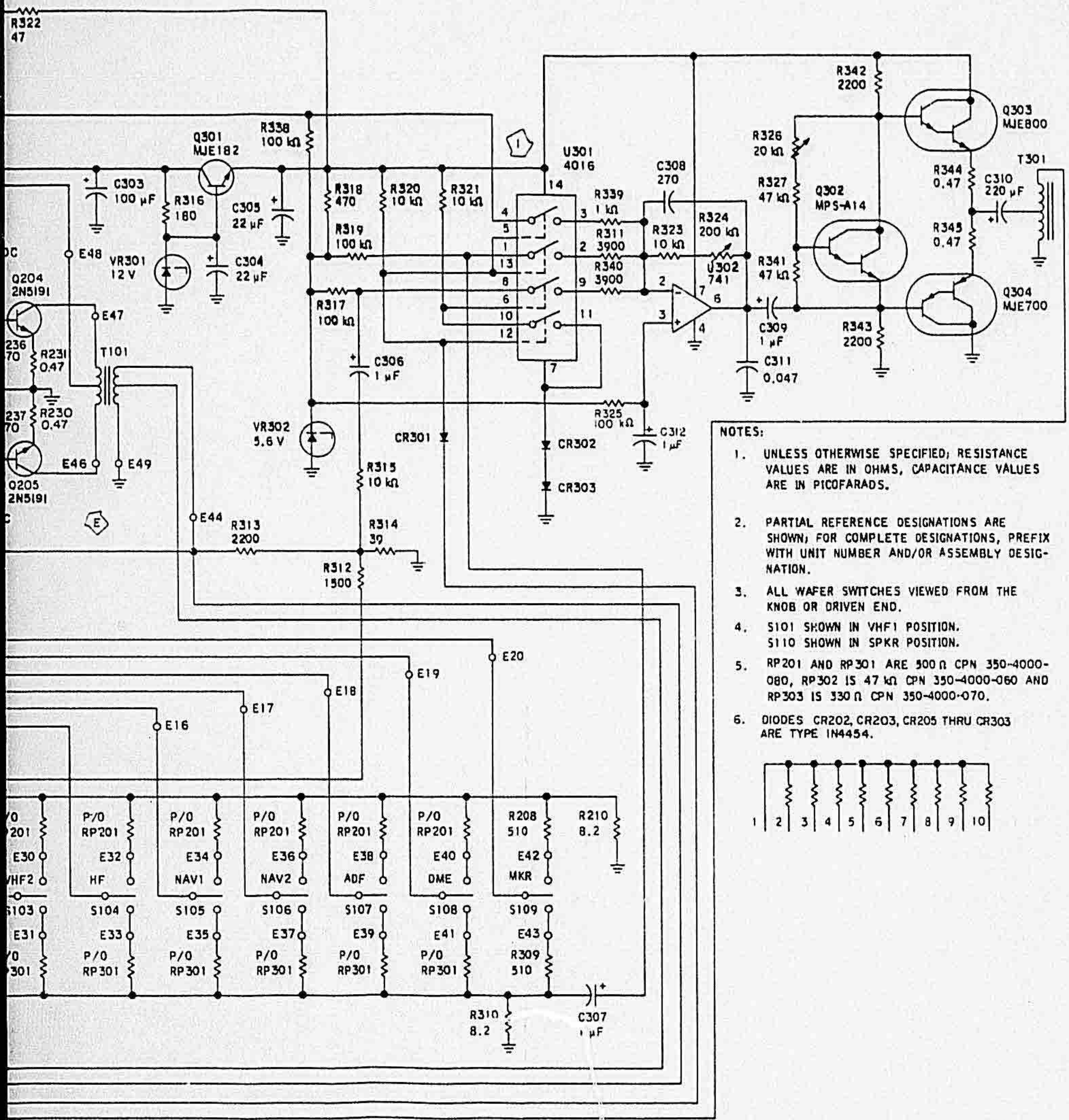


PG 6-59/6-60

6-59/6-60

SEE BLOW-UP FICHE NO. CRL103 - ITEM M

SEE BLOW-UP FICHE



NOTES:

1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICOFARADS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
3. ALL WAFER SWITCHES VIEWED FROM THE KNOB OR DRIVEN END.
4. S101 SHOWN IN VHF1 POSITION. S110 SHOWN IN SPKR POSITION.
5. RP201 AND RP301 ARE 300 Ω CPN 350-4000-080, RP302 IS 47 kΩ CPN 350-4000-060 AND RP303 IS 330 Ω CPN 350-4000-070.
6. DIODES CR202, CR203, CR205 THRU CR303 ARE TYPE 1N4454.

AUD-251H Audio Panel (CPN 628-6113-001), Schematic Diagram
Figure 6-17

SEE BLOW-UP FICHE NO. CRL103 - ITEM M

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
	(This page will contain schematic revision information.)		

AUD-251H Audio Panel (CPN 628-6113-002), Schematic Diagram
Figure 6-17A (Sheet A)

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
C201	CAPACITOR, FIXED, TANTALUM, 0.22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, POLYESTER, 1500PF, ±5%, 100V	933-1404-120
C203	CAPACITOR, FIXED, TANTALUM, 3.3UF, ±20%, 6V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100%, 20V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM, 3.3UF, ±20%, 6V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC, 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC, 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC, 0.01UF, -20/+80%, 50V	913-3298-130
C213	CAPACITOR, FIXED, CERAMIC, 0.01UF, -20/+80%, 50V	913-3298-130
C214	CAPACITOR, FIXED, ELECTROLYTIC, 220UF, -20/+100%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC, 120PF, ±5%, 50V	913-3308-210
C217	CAPACITOR, FXD, CER DIEL, 680PF, 20%, 1000V (EFF REV H)	913-1194-000
C218 thru C300	NOT USED	
C301	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 20V	183-1471-120
C302	CAPACITOR, FIXED, CER DIEL, 1UF, ±20%, 50V	913-3270-270
C303	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, -20/+100%, 50V	183-1471-220
C304	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100%, 20V	183-1471-180
C305	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, -20/+100%, 20V	183-1471-180
C306	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C307	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C308	CAPACITOR, FIXED, MICA, 270PF, ±5%, 300V	912-2099-400
C309	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C310	CAPACITOR, FIXED, ELECTROLYTIC, 220UF, -20/+100%, 10V	183-1471-210
C311	CAPACITOR, FIXED, CERAMIC, 0.047UF, -20/+80%, 25V	913-3298-050
C312	CAPACITOR, FIXED, TANTALUM, 1UF, 20%, 35V	184-9113-030
CR201	DIODE, 1N4003	353-6442-010
CR202	DIODE, 1N4454	353-3741-010
CR203	DIODE, 1N4454	353-3741-010
CR204	DIODE, 1N4003	353-6442-010
CR205	DIODE, 1N4454	353-3741-010

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
CR206	DIODE, 1N4454	353-3741-010
CR207 thru CR300	NOT USED	
CR301	DIODE, 1N4454	353-3741-010
CR302	DIODE, 1N4454	353-3741-010
CR303	DIODE, 1N4454	353-3741-010
DS1 thru DS100	NOT USED	
DS101	LAMP, 14V, 65MA	262-1398-080
DS102	LAMP, 14V, 65MA	262-1398-080
DS103	LAMP, 14V, 65MA	262-1398-080
DS104	LAMP, 14V, 65MA	262-1398-080
Q1 thru Q200	NOT USED	
Q201	TRANSISTOR, 2N2222	352-5021-010
Q202	TRANSISTOR, 2N2222	352-5021-010
Q203	TRANSISTOR, 2N2222	352-5021-010
Q204	TRANSISTOR, 2N5191	352-0924-020
Q205	TRANSISTOR, 2N5191	352-0924-020
Q206	TRANSISTOR, MJE 182	352-5011-010
Q207	TRANSISTOR, 2N2222	352-5021-010
Q208	TRANSISTOR, 2N2222	352-5021-010
Q209 thru Q300	NOT USED	
Q301	TRANSISTOR, MJE 182	352-5011-010
Q302	TRANSISTOR, MPSA 14	352-5035-010
Q303	TRANSISTOR, MJE 800	352-5028-010
Q304	TRANSISTOR, MJE 700	352-5028-020
R1 thru R207	NOT USED	
R208	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R209	NOT USED	
R210	RESISTOR, FIXED, COMPOSITION, 8.2 OHMS, ±5%, 1/4W	745-7958-010
R211	RESISTOR, FIXED, COMPOSITION, 22K, ±10%, 1/4W	745-7950-410
R212	RESISTOR, FIXED, COMPOSITION, 68K, ±10%, 1/4W	745-7950-470
R213	RESISTOR, FXD, FILM, 249 OHMS, 1%, 1/8W	745-7955-670
R214	RESISTOR, FIXED, FILM, 34K, ±1%, 1/8W	745-7957-740
R215	RESISTOR, FIXED, COMPOSITION, 33K, ±10%, 1/4W	745-7950-430
R216	RESISTOR, FIXED, COMPOSITION, 1K, ±10%, 1/4W	745-7950-250
R217	RESISTOR, FIXED, COMPOSITION, 120 OHMS, ±10%, 1/4W	745-7950-140
R218	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±10%, 1/4W	745-7950-130
R219	RESISTOR, VARIABLE, SINGLE TURN, 1K, ±30%, 0.1W	382-0500-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, ±10%, 1/4W	745-7950-420
R221	RESISTOR, FIXED, COMPOSITION. 5.6K, ±10%, 1/4W	745-7950-340
R222	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±10%, 1/4W	745-7950-170
R223	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±10%, 1/4W	745-7950-170
R224	TEST SELECT VALUES	
R224	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370

Revised 30 July 1984

PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
R224	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R224	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R224	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R224	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R225	TEST SELECT VALUES	
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R225	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R226	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R227	RESISTOR, FIXED, COMPOSITION, 1K, ±10%, 1/4W	745-7950-250
R228	RESISTOR, VARIABLE, SINGLE TURN, 20K, ±30%, 0.1W	382-0500-040
R229	RESISTOR, VARIABLE, SINGLE TURN, 20K, ±30%, 0.1W	382-0500-040
R230	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34K, ±1%, 1/8W	745-7957-740
R233	NOT USED	
R234	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1W	745-7952-210
R235	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R236	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R237	RESISTOR, FXD, CMPSN, 470 OHMS, 10%, 1/4W	745-7950-210
R238 thru R300	NOT USED	
R301	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R302 thru R308	NOT USED	
R309	RESISTOR, FIXED, COMPOSITION, 510 OHMS, ±5%, 1/4W	745-7958-130
R310	RESISTOR, FIXED, WIREWOUND, 1 OHM, 1%, 1W	747-4230-010
R311	RESISTOR, FIXED, COMPOSITION, 470 OHM, 5%, 1/4W	745-0736-000
R312	RESISTOR, FIXED, COMPOSITION, 1.5K, ±10%, 1/4W	745-7950-270
E313	RESISTOR, FIXED, COMPOSITION, 2.2K, ±10%, 1/4W	745-7950-290
R314	RESISTOR, FIXED, COMPOSITION, 39 OHMS, ±10%, 1/4W	745-7950-080
R315	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R316	RESISTOR, FIXED, WIREWOUND, 180 OHMS, ±5%, 3W	745-7953-060
R317	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R318	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1/4W	745-7950-210
R319	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R320	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R321	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R322	RESISTOR, FIXED, COMPOSITION, 47 OHMS, ±10%, 1/4W	745-7950-090
R323	RESISTOR, FIXED, COMPOSITION, 10K, ±10%, 1/4W	745-7950-370
R324	RESISTOR, VARIABLE, SINGLE TURN, 200K, ±30%, 0.1W	382-0500-050
R325	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R326	RESISTOR, VARIABLE, SINGLE TURN, 20K, ±30%, 0.1W	382-0500-050
R327	RESISTOR, FIXED, COMPOSITION, 47K, ±10%, 1/4W	745-7950-450

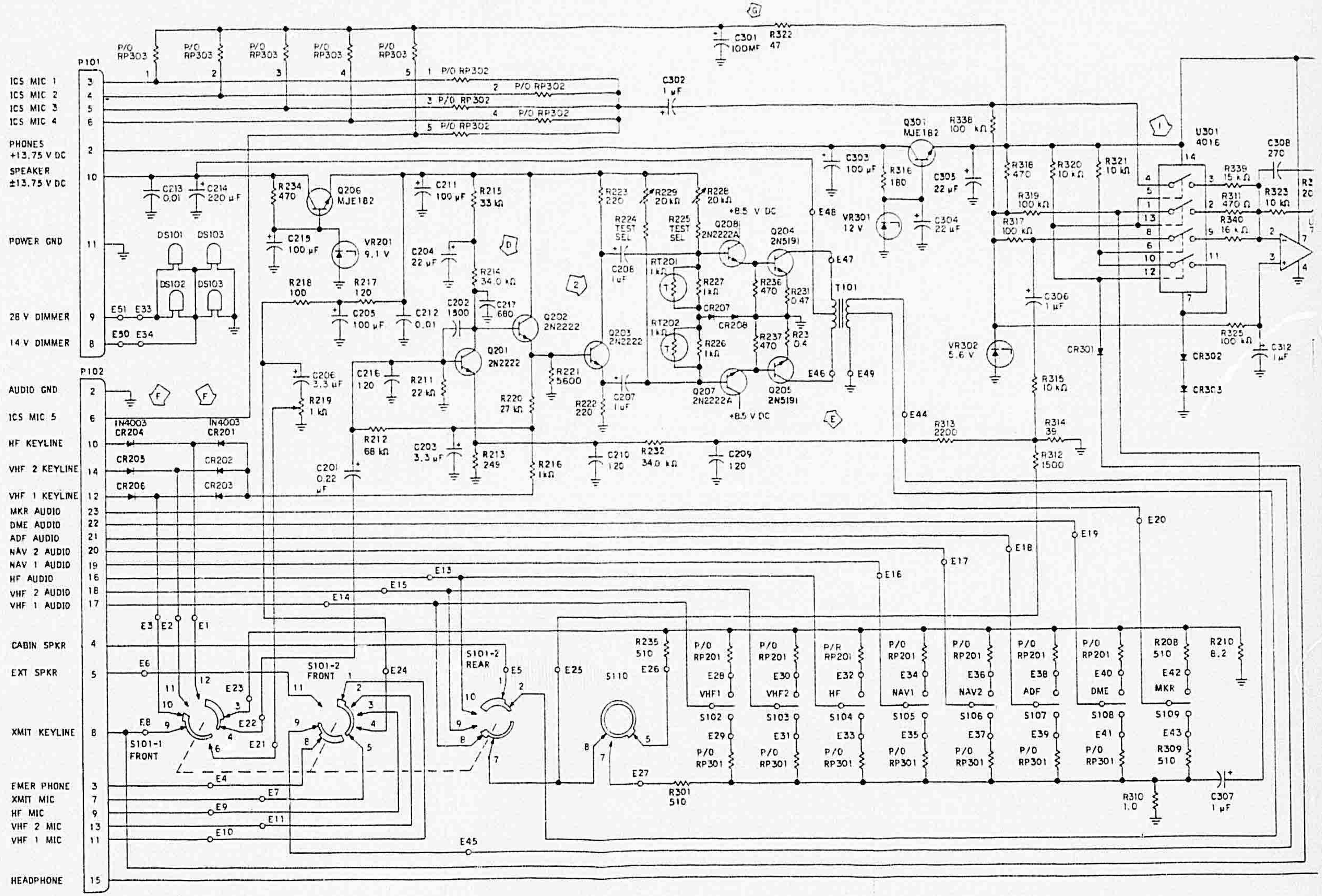
PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-002

SYMBOL	DESCRIPTION	PART NUMBER
R328 thru R337	NOT USED	
R338	RESISTOR, FIXED, COMPOSITION, 100K, ±10%, 1/4W	745-7950-490
R339	RESISTOR, FIXED, COMPOSITION, 47K, 5%, 1/4W	745-0808-000
R340	RESISTOR, FIXED, COMPOSITION, 16K, 5%, 1/4W	745-0792-000
R341	RESISTOR, FIXED, COMPOSITION, 47K, ±10%, 1/4W	745-7950-450
R342	RESISTOR, FIXED, COMPOSITION, 2.2K, ±10%, 1/4W	745-7950-290
R343	RESISTOR, FIXED, COMPOSITION, 2.2K, ±10%, 1/4W	745-7950-290
R344	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
R345	RESISTOR, FIXED, WIREWOUND, 0.47 OHMS, ±10%, 2W	745-0909-020
RP1 thru RP200	NOT USED	
RP201	RESISTOR, NETWORK, SINGLE IN-LINE, 8 PIN, 500 OHMS, ±5%, 1/8W	350-4000-080
RP202 thru RP300	NOT USED	
RP301	RESISTOR, NETWORK, SINGLE IN-LINE, 8 PIN, 500 OHMS, ±5%, 1/8W	350-4000-080
RP302	RESISTOR, NETWORK, SINGLE IN-LINE, 6 PIN, 47K, ±10%, 1/8W	350-4000-060
RP303	RESISTOR, NETWORK, SINGLE IN-LINE, 6 PIN, 300 OHMS, ±10%	350-4000-070
RT1-RT200	NOT USED	
RT201	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W	714-3255-010
RT202	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W	714-3255-010
S1 thru S100	NOT USED	
S101	SWITCH, 4 POSITION WAFER, 2 SECTION	259-1024-110
S102	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S103	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S104	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S150	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S106	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S107	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S108	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S109	SWITCH, TOGGLE/CAP, SPDT	*266-5417-130/ 266-5417-140
S110	SWITCH, 3 POSITION WAFER	259-1024-120

*PART NUMBERS ARE SWITCH/LEVER CAP.

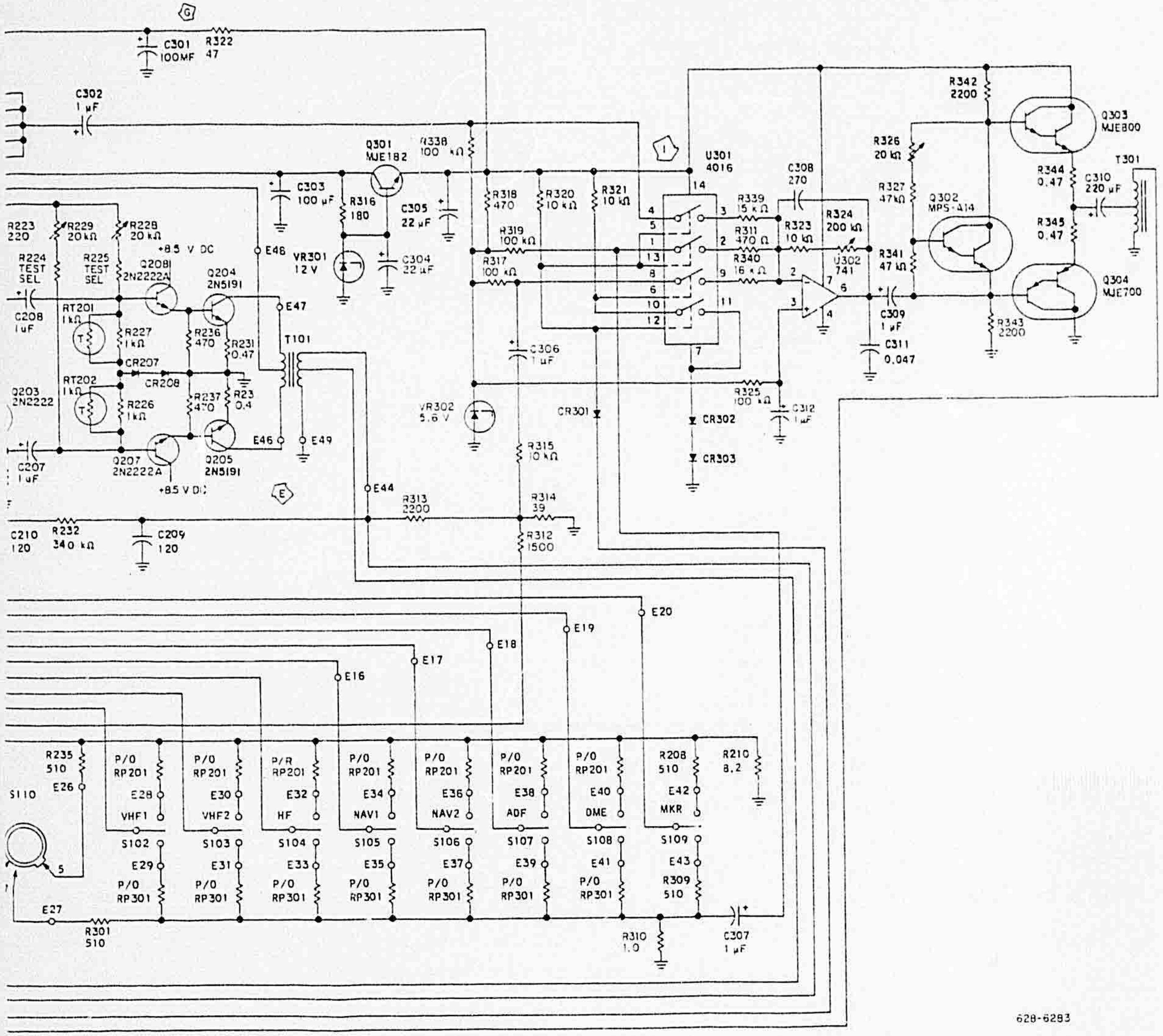
PARTS LIST
AUD-251H AUDIO PANEL
ASSEMBLY 628-6113-002

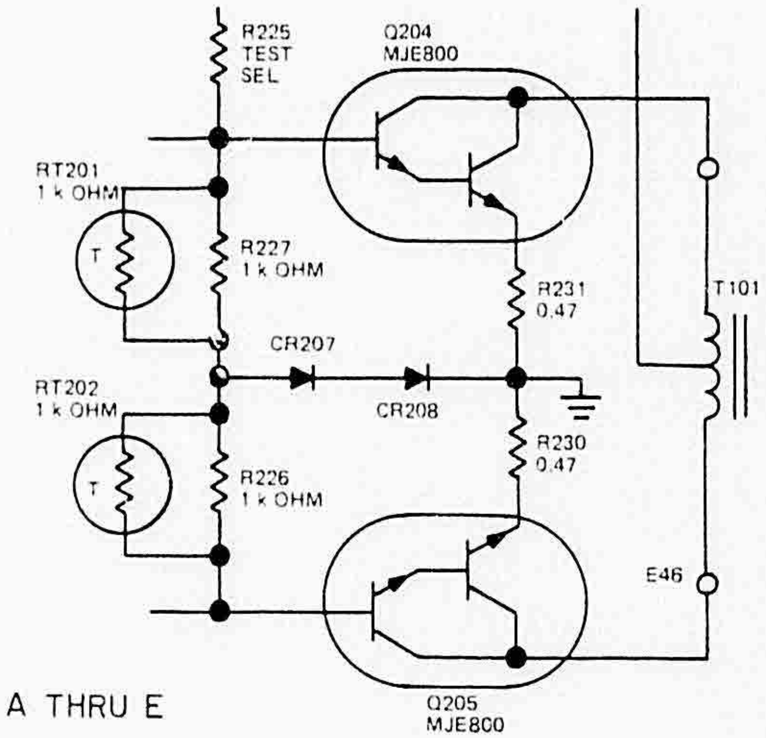
SYMBOL	DESCRIPTION	PART NUMBER
T1 thru T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
T102 thru T300	NOT USED	
T301	TRANSFORMER, HEADPHONE	667-0279-010
U1 thru U300	NOT USED	
U301	COMPLEMENTARY MOS QUAD BILATERAL SWITCH, 4016	351-8260-010
VR1 thru VR200	NOT USED	
VR201	ZENER DIODE, 9.1V	353-3737-130
VR202 thru VR300	NOT USED	
VR301	ZENER DIODE, 12V	353-3738-090
VR302	ZENER DIODE, 5.6V	353-3737-050



SEE BLOW-UP FICHE NO. CRL103 - ITEM Q

6-605/6-60K





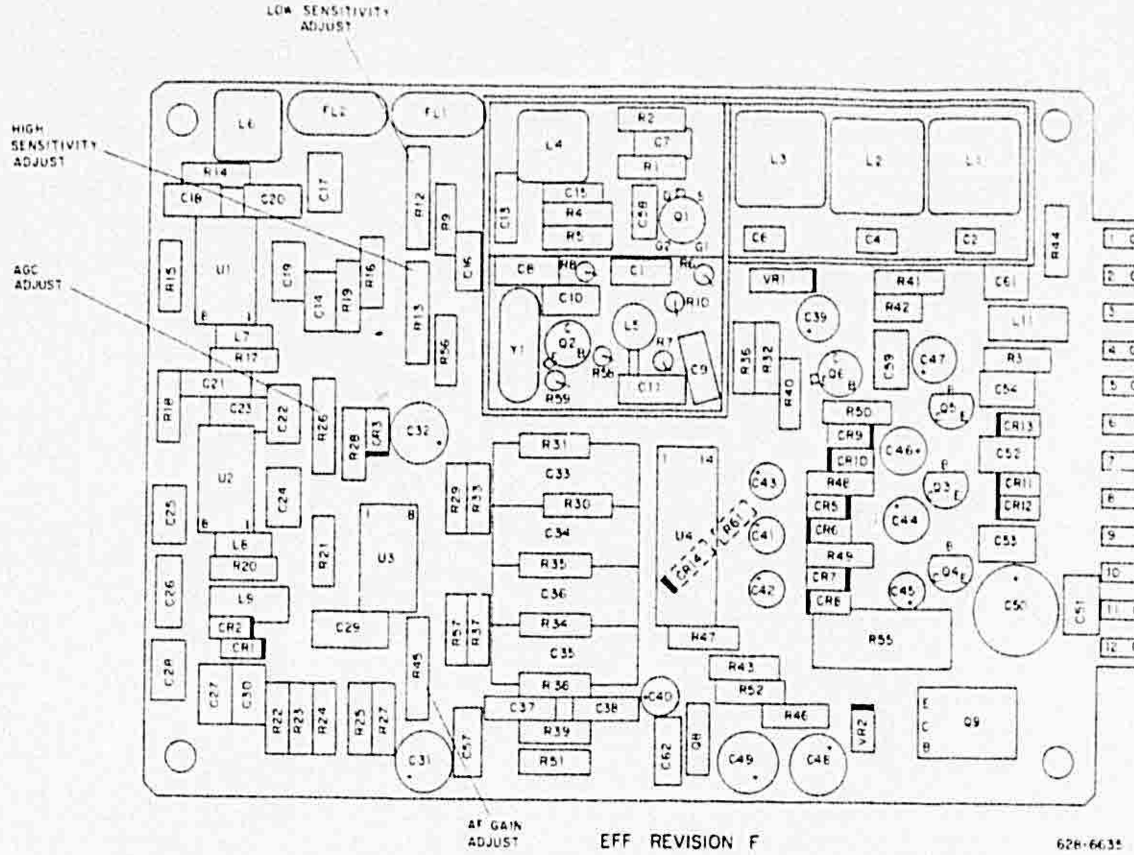
REVISIONS A THRU E

628-7597

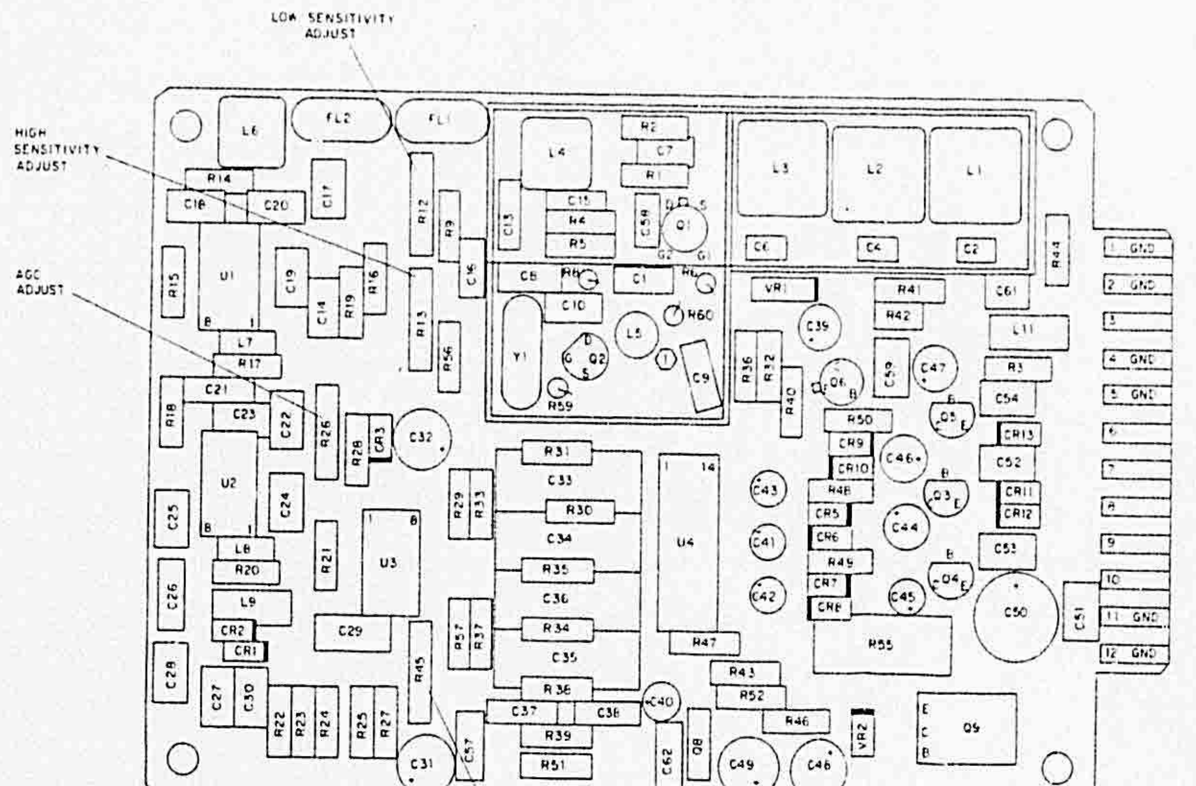
628-6283

AUD-251H Audio Panel (CPN 628-6113-002), Schematic Diagram Figure 6-17A

SEE BLOW-UP FICHE NO. CRL103 - ITEM Q



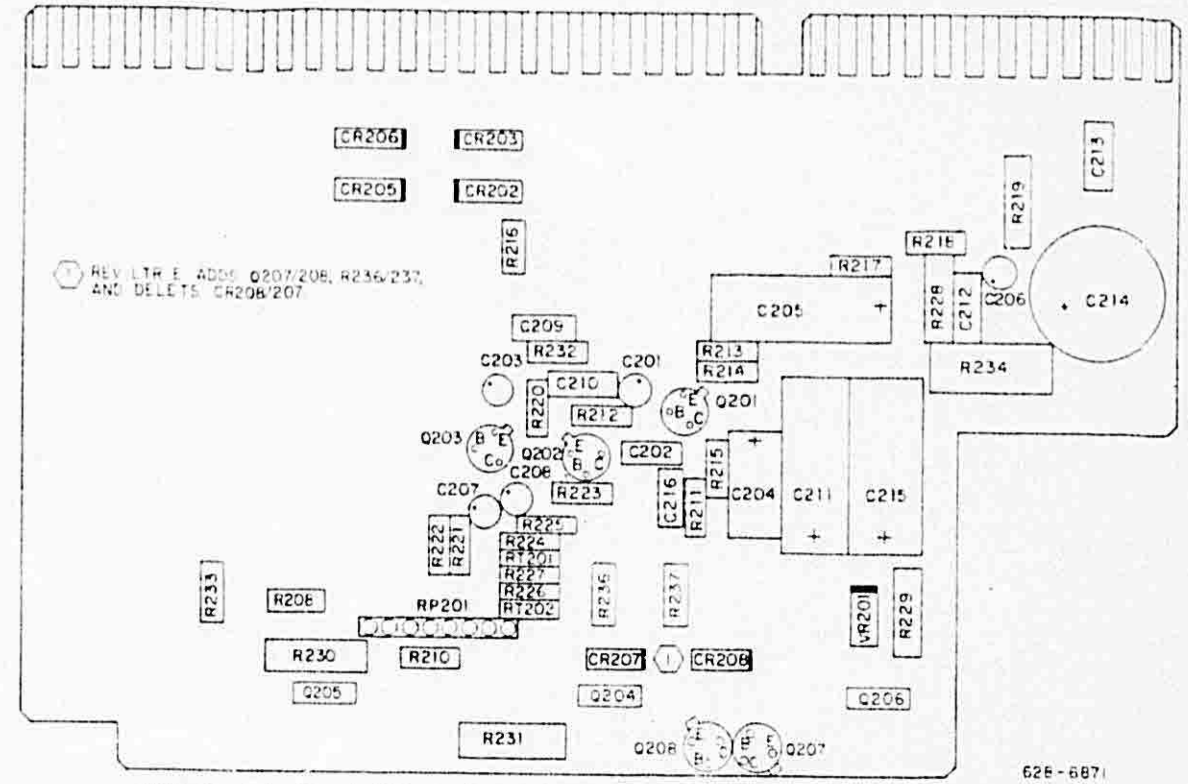
AMR-350 Marker Board, Component Location Diagram (Effective to Revision P)
Figure 18



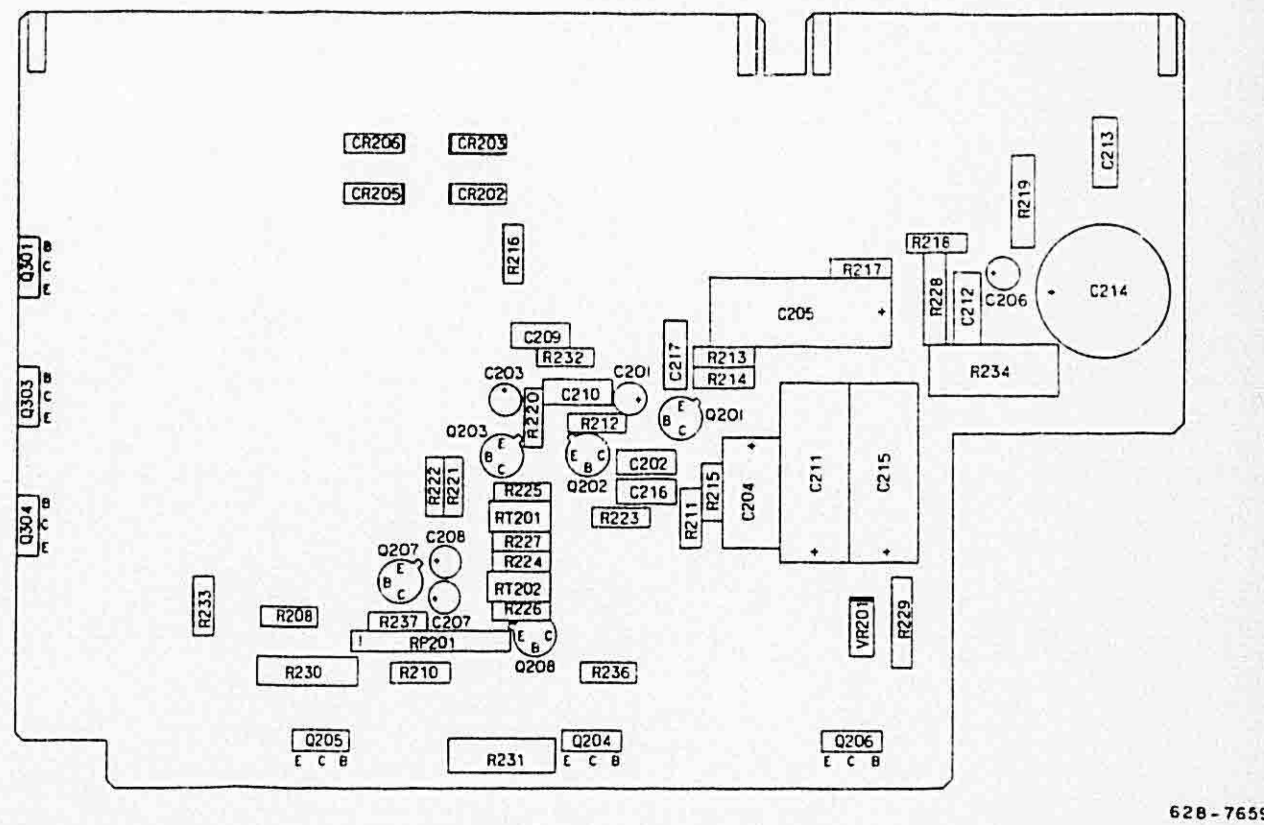
NOTES
1 R60 IS ADDED EFF REVISION R

AMR-350 Marker Board, Component Location Diagram (Effective Revision P)
Figure 18A

SEE BLOW–UP FICHE NO. CRL103 - ITEM U



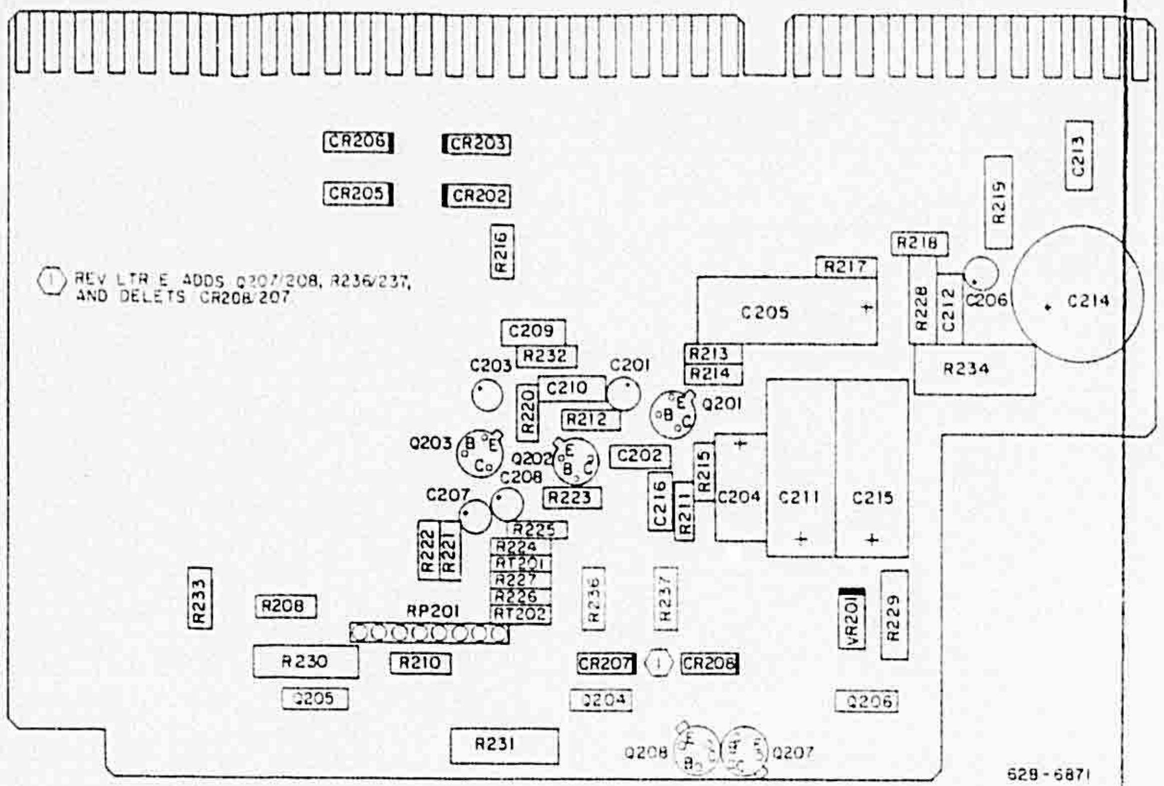
AMR-350 Audio Board, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-19



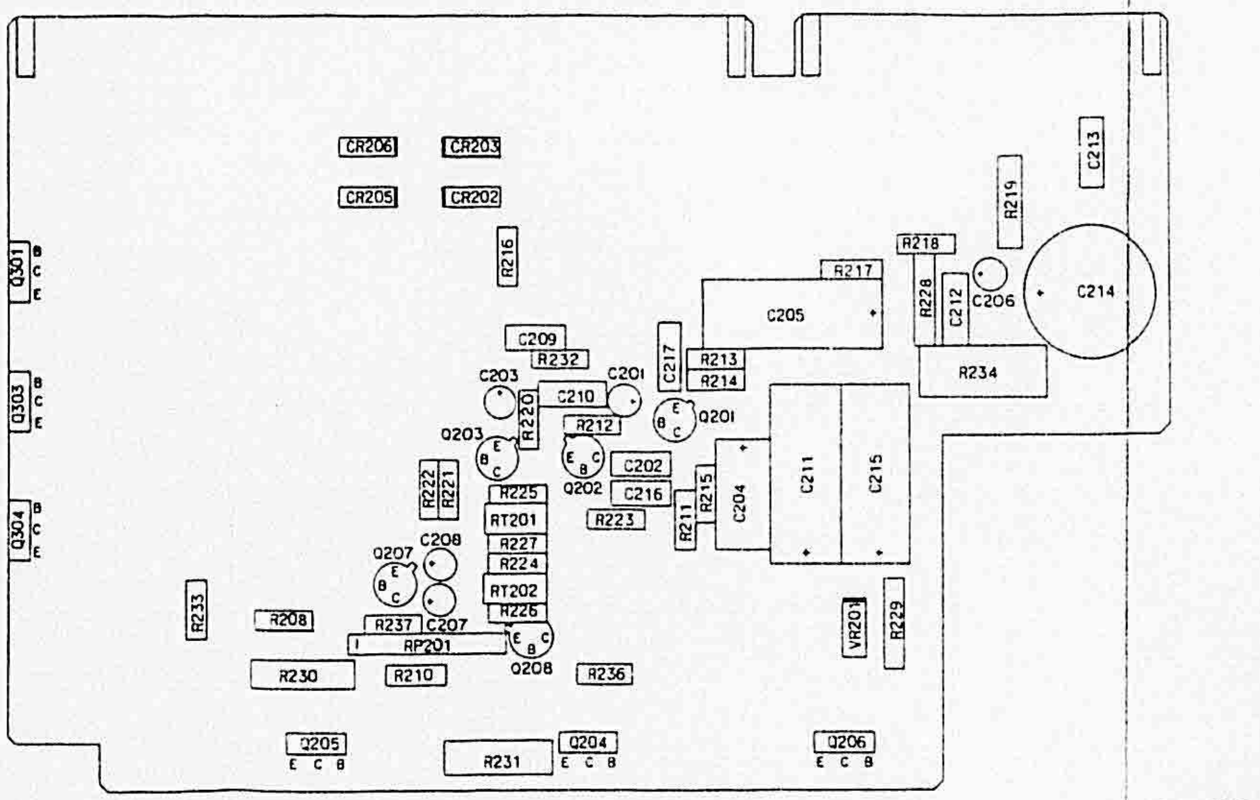
AMR-350 Audio Board, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-20

6-652/61om

SEE BLOW–UP FICHE NO. CRL103 - ITEM V



AMR-350 Audio Board, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-19



AMR-350 Audio Board, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-20

SEE BLOW-UP FICHE NO. CRL103 - ITEM U

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Changed value of R213 from 267 to 249 Ω, R226 and R227 from 470 Ω to 1 kΩ; changed R224 and R225 from 22 kΩ to test select components; added RT201 and RT202. Changes prevent thermal runaway in 27.5-V installations.	SB 1	REV D
2	Added Q207, Q208, R236, and R237. Changed Q204 and Q205 from MJE 800 to MJE 521. Changes prevent thermal runaway. Refer to schematic apron for diagram of affected area prior to revision E.	NA	REV E
C	Added C217 to prevent no-load oscillation.	NA	REV H
D	Changed Q204 and Q205 from MJE 521 to 2N5191 to improve reliability.	NA	REV W
D, Marker receiver schematic	Changed C8 from 120 to 68 pF, C10 from 10 to 12 pF. Deleted C11, R7, R10, R58. Changed Q2 from 2N918 to MPF 820.	SB 5	REV P
G, Marker receiver schematic	Changed R51 from 10 to 6.34 kΩ, R52 from 10% to 1% part. Added R61, CR14.	SB 6	REV T

AMR-350 Audio/Marker Panel, Effective Audio Board Number 628-6114-XXX, Schematic Diagram
Figure 6-21 (Sheet A)

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C1	CAPACITOR, FIXED, MICA DIELECTRIC, 5PF ±1/2PF, 300V	912-2106-090
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C3	NOT USED	
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C5	NOT USED	
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C8	CAPACITOR, FXD, MICA DIEL, 68PF, ±5%, 300 V (EFF REV P; SB 5)	912-2099-250
C8	CAPACITOR, FIXED, MICA DIEL, 120PF, 5%, 300V (EFF REV L; SB 2)	912-2106-150
C8	CAPACITOR, FIXED, MICA DIELECTRIC, 150PF, ±5% 300V	912-2106-100
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C10	CAPACITOR, FXD, MICA DIEL, 12PF, ±1/2PF, 300V (EFF REV P; SB 5)	912-2099-100
C10	CAPACITOR, FIXED, MICA DIELECTRIC, 10PF, ±1/2PF, 300V	912-2106-020
C11	NOT USED (EFF REF P; SB 2)	
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C12	NOT USED	
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C29	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C31	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C32	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C33	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-160
C34	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-160
C35	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.01UF, ±5%, 100V	933-1404-150
C36	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.01UF, ±5%, 100V	933-1404-150
C37	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-140
C38	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-140
C39	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C40	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C41	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C42	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C43	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C44	CAPACITOR, FIXED, TANTALUM, 10UF, ±20%, 20V	184-9113-070
C45	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C46	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C47	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C48	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 16V	183-1471-100

Revised 9 June 1982

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C49	CAPACITOR, FIXED, ELECTROLYTIC, 33UF, +100-20%, 16V	183-1471-040
C50	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 35V	183-1471-190
C51	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.047UF, 20%, 50V	913-3306-060
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C54	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C55	NOT USED	
C56	NOT USED	
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C60	NOT USED	
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05PF, +80-20%, 12V	913-3298-010
C63-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC, DIELECTRIC 1500PF, ±5%, 100V	933-1404-120
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC 0.01 UF, +80-20%, 50V	913-3298-130
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC 0.01 UF, +80-20%, 50V	913-3298-130

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C217	CAPACITOR, FXD, CER DIEL, 680PF, 20%, 1000V (EFF REV H)	913-1194-000
CR1	DIODE, 1N4454	353-3741-010
CR2	DIODE, 1N4454	353-3741-010
CR3	DIODE, 1N4454	353-3741-010
CR4	NOT USED	
CR5	DIODE, 1N4454	353-3741-010
CR6	DIODE, 1N4454	353-3741-010
CR7	DIODE, 1N4454	353-3741-010
CR8	DIODE, 1N4454	353-3741-010
CR9	DIODE, 1N4454	353-3741-010
CR10	DIODE, 1N4454	353-3741-010
CR11	DIODE, 1N4454	353-3741-010
CR12	DIODE, 1N4454	353-3741-010
CR13	DIODE, 1N4454	353-3741-010
CR14	DIODE, 1N4454 (EFF REV T; SB 6)	353-3741-010
CR15-CR200	NOT USED	
CR201	NOT USED	
CR202	DIODE, 1N4454	353-3741-010
CR203	DIODE, 1N4454	353-3741-010
CR204	NOT USED	
CR205	DIODE, 1N4454	353-3741-010
CR206	DIODE, 1N4454	353-3741-010
CR207	NOT USED (EFF REV E)	
CR207	DIODE, 1N4454	353-3741-010
CR208	NOT USED (EFF REV E)	
CR208	DIODE, 1N4454	353-3741-010
DS1	LAMP	262-1398-070
DS2	LAMP	262-1398-070
DS3	LAMP	262-1398-070
DS4-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
FL1	FILTER, BANDPASS, CRYSTAL, 10.7MHz	293-1305-010
FL2	FILTER, BANDPASS, CRYSTAL, 10.7MHz	293-1305-010
L1	COIL, 75MHz	278-0420-010
L2	COIL, 75MHz	278-0420-010
L3	COIL, 75MHz	278-0420-010
L4	COIL, 10.7MHz	278-0419-010
L5	COIL, VARIABLE	242-0438-010

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
L6	COIL, 10.7MHz	278-0419-010
L7	COIL, 3.3UH	240-2742-160
L8	COIL, 3.3UH	240-2742-160
L9	COIL, 100UH	240-2742-170
L10	NOT USED	
L11	COIL, 0.68UH	240-2742-020
Q1	TRANSISTOR, 40841	352-5005-010
Q2	TRANSISTOR, MPF820 (EFF REV P; SB 5)	352-5013-030
Q2	TRANSISTOR, 2N918	352-5027-020
Q3	TRANSISTOR, MPS A-14	352-5035-010
Q4	TRANSISTOR, MPS A-14	352-5035-010
Q5	TRANSISTOR, MPS A-14	352-5035-010
Q6	TRANSISTOR, 2N2222A	353-5021-010
Q7	NOT USED	
Q8	TRANSISTOR, MJE-800	352-5028-010
Q9	TRANSISTOR, MJE-182	352-5011-010
Q10-Q200	NOT USED	
Q201	TRANSISTOR, 2N2222	352-5021-010
Q202	TRANSISTOR, 2N2222	352-5021-010
Q203	TRANSISTOR, 2N2222	352-5021-010
Q204	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q204	TRANSISTOR, MJE-521 (EFF REV E)	352-5064-010
Q204	TRANSISTOR, MJE 800	352-5028-010
Q205	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q205	TRANSISTOR, MJE 521 (EFF REV E)	352-5064-010
Q205	TRANSISTOR, MJE 800	352-5028-010
Q206	TRANSISTOR, MJE 182	352-5011-010
Q207	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
Q208	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
R1	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R2	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 10%, 1/4W	745-7950-130
R3	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 10%, 1/4W	745-7950-140
R4	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 10% 1/4W	745-7950-370
R5	RESISTOR, FIXED, COMPOSITION, 180 OHMS, 10%, 1/4W	745-7950-160
R6	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 10%, 1/4W	745-7950-130
R7	NOT USED (EFF REV P; SB 5)	
R7	RESISTOR, FIXED, COMPOSITION, 1.5K, 10%, 1/4W (EFF REV L; SB 2)	745-7950-270
R7	RESISTOR, FIXED, COMPOSITION, 15K, 10%, 1/4W	745-7950-390
R8	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R9	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R10	NOT USED (EFF REV P; SB 5)	
R10	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R11	NOT USED	
R12	RESISTOR, VARIABLE, 10K, ±20%, 0.5W	382-0045-030
R13	RESISTOR, VARIABLE, 10K, ±20%, 0.5W	382-0045-030

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R14	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R15	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R16	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R17	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R18	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R19	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R20	RESISTOR, FIXED, COMPOSITION, 820 OHMS, 10%, 1/4W	745-7950-240
R21	RESISTOR, FIXED, COMPOSITION, 3.9K, 10%, 1/4W	745-7950-320
R22	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R23	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R24	RESISTOR, FIXED, COMPOSITION, 82K, 10%, 1/4W (EFF REV L)	745-7950-480
R24	RESISTOR, FIXED, COMPOSITION, 56K, 10%, 1/4W	745-7950-460
R25	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R26	RESISTOR, VARIABLE, 10K, 30%, 0.1W	382-0049-050
R27	RESISTOR, FIXED, COMPOSITION, 3.3K, 10%, 1/4W	745-7950-310
R28	RESISTOR, FIXED, COMPOSITION, 4.7K, 10%, 1/4W	745-7950-330
R29	RESISTOR, FIXED, FILM, 12,100 OHMS, ±1%, 1/8W	745-7957-310
R30	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R31	RESISTOR, FIXED, FILM, 1820 OHMS, ±1%, 1/8W	745-7956-510
R32	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R33	RESISTOR, FIXED, FILM, 10,000 OHMS, ±1%, 1/8W	745-7957-230
R34	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R35	RESISTOR, FIXED, FILM, 1620 OHMS, ±1%, 1/8W	745-7956-460
R36	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R37	RESISTOR, FIXED, FILM, 15,000 OHMS, ±1%, 1/8W	745-7957-400
R38	RESISTOR, FIXED, FILM, 130,000 OHMS, ±1%, 1/8W	745-7403-310
R39	RESISTOR, FIXED, FILM, 2100 OHMS, ±1%, 1/8W	745-7956-570
R40	RESISTOR, FIXED, FILM, 130K, 1%, 1/8W	745-7403-310
R41	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 560K, 10%, 1/4W	745-7950-580
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 680K, 10%, 1/4W	745-7950-590
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 820K, 10%, 1/4W	745-7950-600
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1M, 10%, 1/4W	745-7950-610
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1.2M, 10%, 1/4W	745-7950-620
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1.5M, 10%, 1/4W	745-7950-630
R43	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R44	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R45	RESISTOR, VARIABLE, 10K, 30%, 0.1W	382-0049-050

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R46	RESISTOR, FIXED, COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R47	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R48	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R49	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R50	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R51	RESISTOR, FIXED, FILM, 6.34K, 1%, 1/8W (EFF REV T; SB 6)	705-3605-380
R51	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R52	RESISTOR, FIXED, FILM, 10K, 1%, 1/8W, (EFF REV T; SB 6)	705-1044-000
R52	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R53	NOT USED	
R54	NOT USED	
R55	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1W	745-7952-210
R56	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R57	RESISTOR, FIXED, COMPOSITION, 1.2K, 10%, 1/4W	745-7950-260
R58	NOT USED (EFF REV P; SB 5)	
R58	RESISTOR, FIXED, COMPOSITION, 1.8K, 10%, 1/4W (EFF REV L; SB 2)	745-7950-280
R58	RESISTOR, FIXED, COMPOSITION, 18K, 10%, 1/4W	745-7950-400
R59	RESISTOR, FIXED, COMPOSITION, 680 OHMS, 10%, 1/4W	745-7950-230
R60	NOT USED	
R61	RESISTOR, FXD, CMPSN, 47K, 10%, 1/4W (EFF REV T; SB 6)	745-7950-450
R62-R207	NOT USED	
R208	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R209	NOT USED	
R210	RESISTOR, FIXED, COMPOSITION 8.2 OHMS, ±5%, 1/4W	745-7958-010
R211	RESISTOR, FIXED, COMPOSITION 22K, 10%, 1/4W	745-7950-410
R212	RESISTOR, FIXED, COMPOSITION, 68K, 10%, 1/4W	745-7950-470
R213	RESISTOR, FIXED, FILM, 249 OHMS, 1%, 1/8W (EFF REV D; SB 1)	745-7955-670
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W	745-7955-700
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R215	RESISTOR, FIXED, COMPOSITION 33K, ±10%, 1/4W	745-7950-430
R216	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±10%, 1/4W	745-7950-140
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, ±10%, 1/4W	745-7950-130
R219	RESISTOR, VARIABLE 1K, ±30%, 0.1W	382-0049-020
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, ±10%, 1/4W	745-7950-340
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R224	TEST SELECT VALUES (EFF REV G)	
R224	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R224	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R224	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R224	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430

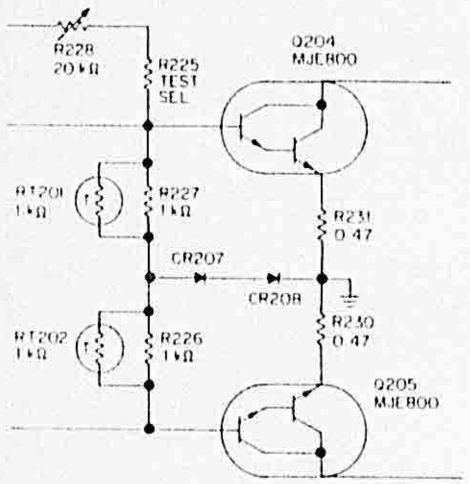
PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R224	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R224	TEST SELECT (EFF REV D; SB1)	
R224	RESISTOR, FIXED, COMPOSITION 22K, ±10%, 1/4W	745-7950-410
R225	TEST SELECT VALUES (EFF REV G)	
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R225	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R225	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FIXED, COMPOSITION, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FIXED, COMPOSITION, 22K, 10%, 1/4W	745-7950-410
R226	RESISTOR, FIXED, COMPOSITION, 1K, ±10%, 1/4W (EFF REV D; SB 1)	745-7950-250
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R228	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R229	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, ±10%, 1/4W	745-7950-310
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
R235	NOT USED	
R236	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
R237	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
RP1-RP200	NOT USED	
RP201	RESISTOR NETWORK, 500 OHMS ±5%, 1/8W	350-4000-080
S1	SWITCH TOGGLE	266-5417-020
S2-S100	NOT USED	
S101	SWITCH, WAFER, 3 POS	259-1024-100
S102	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S103	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-002 AND 628-7605-002

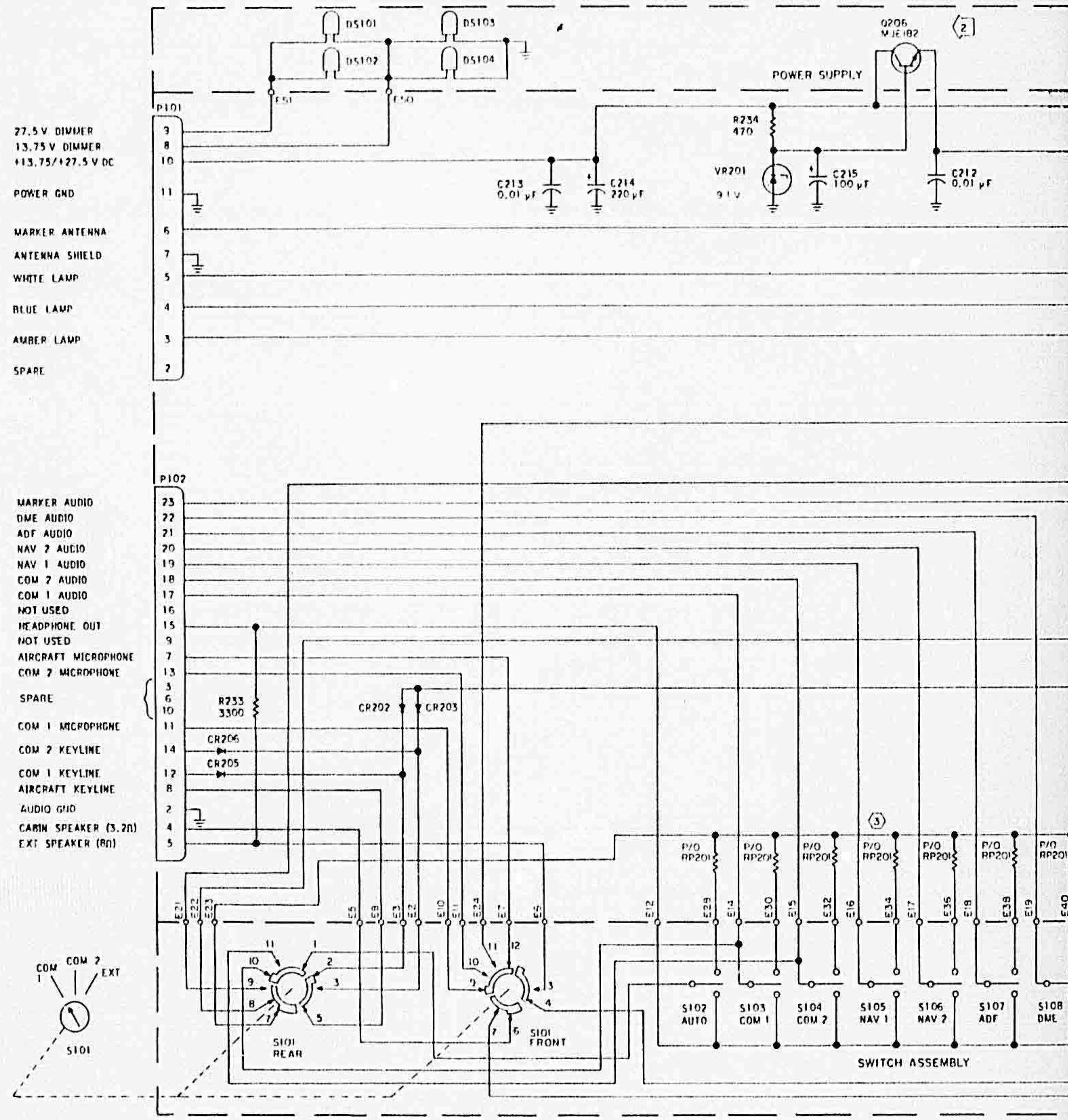
SYMBOL	DESCRIPTION	PART NUMBER
S104	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S105	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S106	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S107	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S108	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S109	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S110	SWITCH, 3 POSITION	259-1024-040
T1-T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
U1	INTEGRATED CIRCUIT, 1350P	351-1134-010
U2	INTEGRATED CIRCUIT, 1350P	351-1134-010
U3	INTEGRATED CIRCUIT, 1458CP1	351-1156-020
U4	INTEGRATED CIRCUIT, 3401P	351-1611-010
V1	PHOTOCELL	353-0449-010
VR1	ZENER DIODE, 1N5231B	353-3740-210
VR2	ZENER DIODE, 1N4739A	353-3737-130
VR3-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130
Y1	CRYSTAL, QUARTZ, 85.70MHZ	289-7260-020

*PART NUMBERS ARE SWITCH/LEVER CAP.



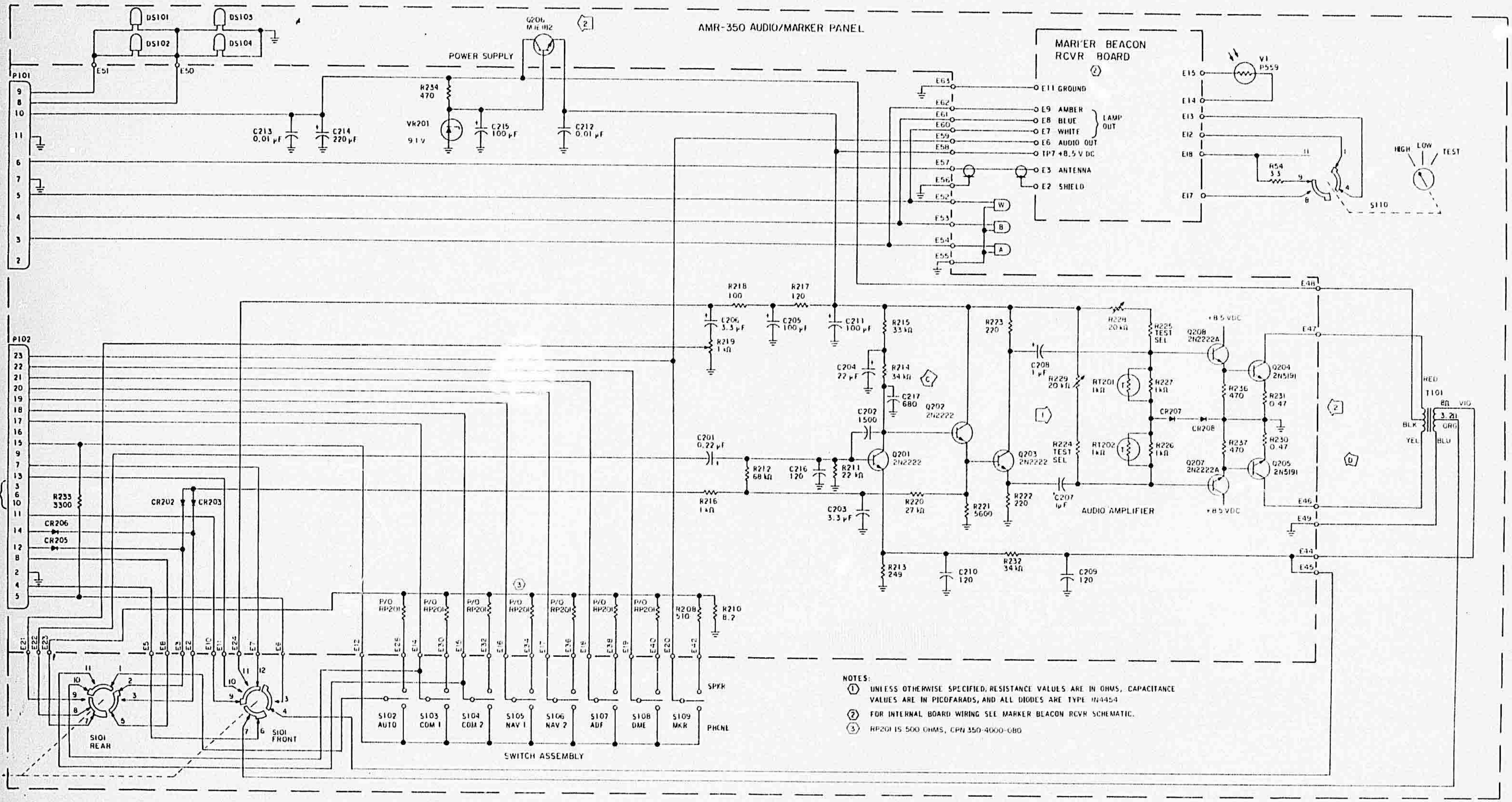
REVISIONS A THROUGH D

628-7475



SEE BLOW-UP FICHE NO. CRL103 - ITEM O

6-71

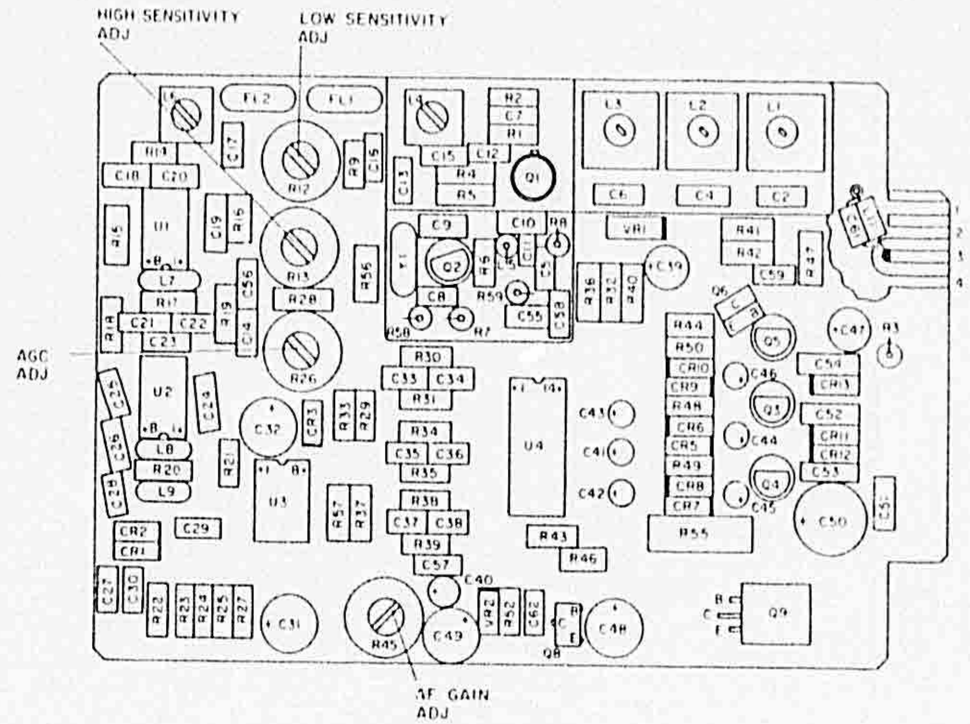


NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL DIODES ARE TYPE 1N4454
2. FOR INTERNAL BOARD WIRING SEE MARKER BEACON RCVR SCHEMATIC.
3. RP201 IS 500 OHMS, CPN 350-4000-080

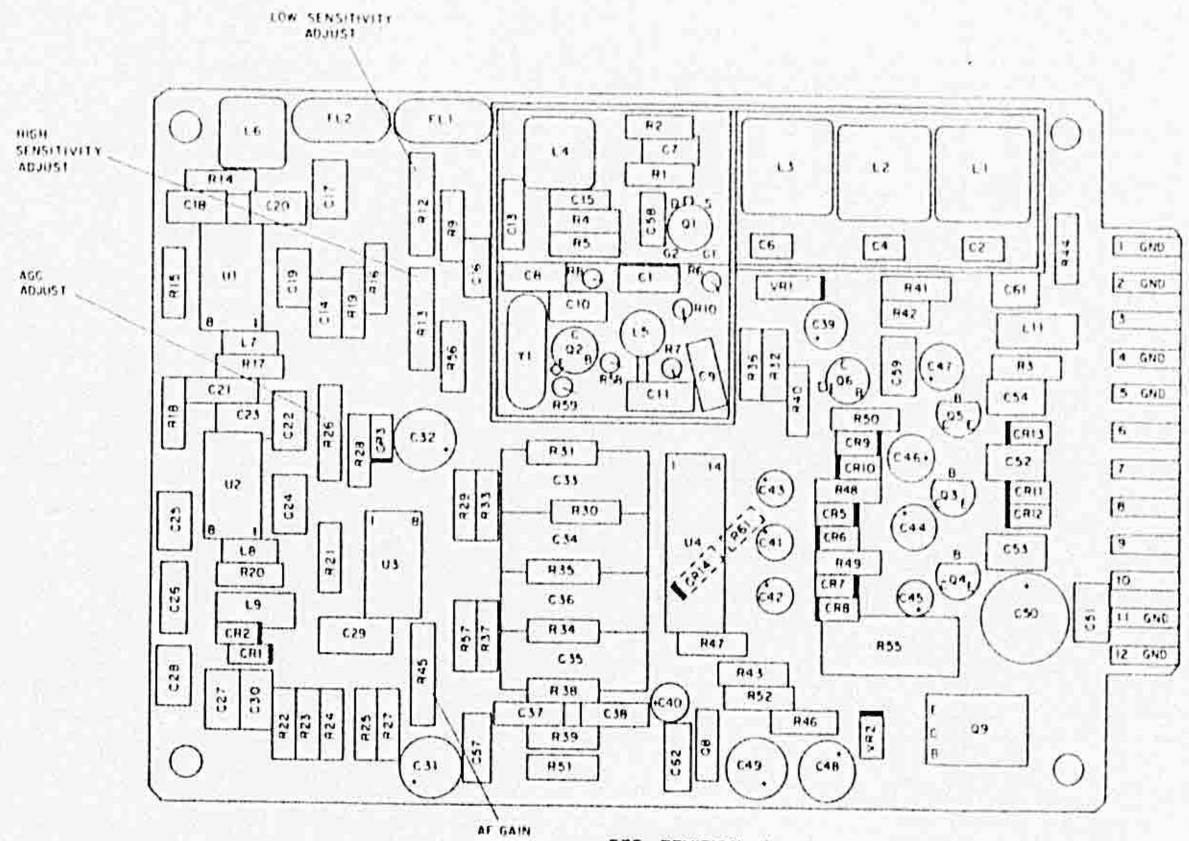
AMR-350 Audio/Marker Panel, Effective Audio Board Number 628-6113-XXX, Schematic Diagram
Figure 6-21

SEE BLOW-UP FICHE NO. CRL103 - ITEM 0



REVISION A THROUGH E

628-5835

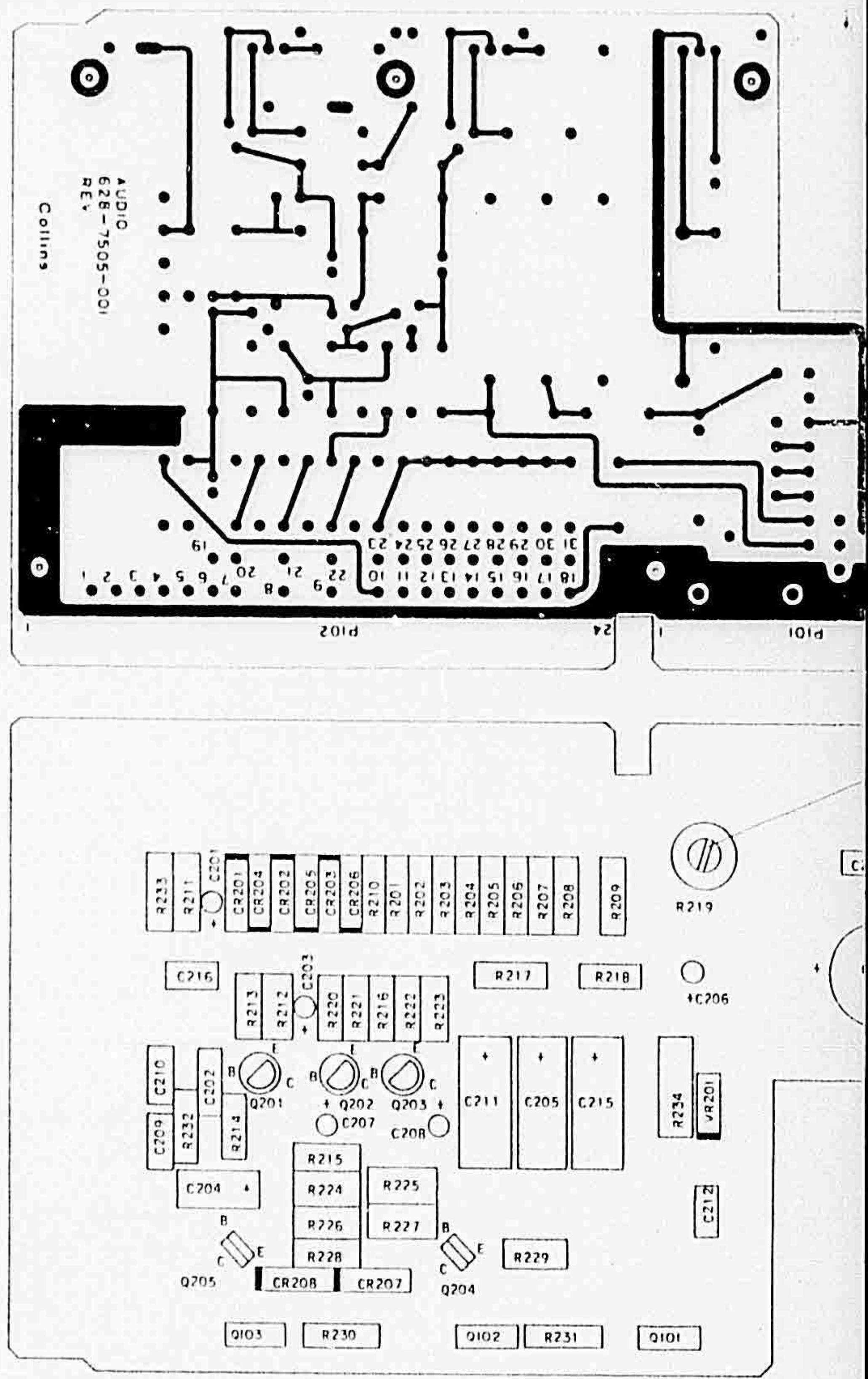


EFF REVISION F

628-6635

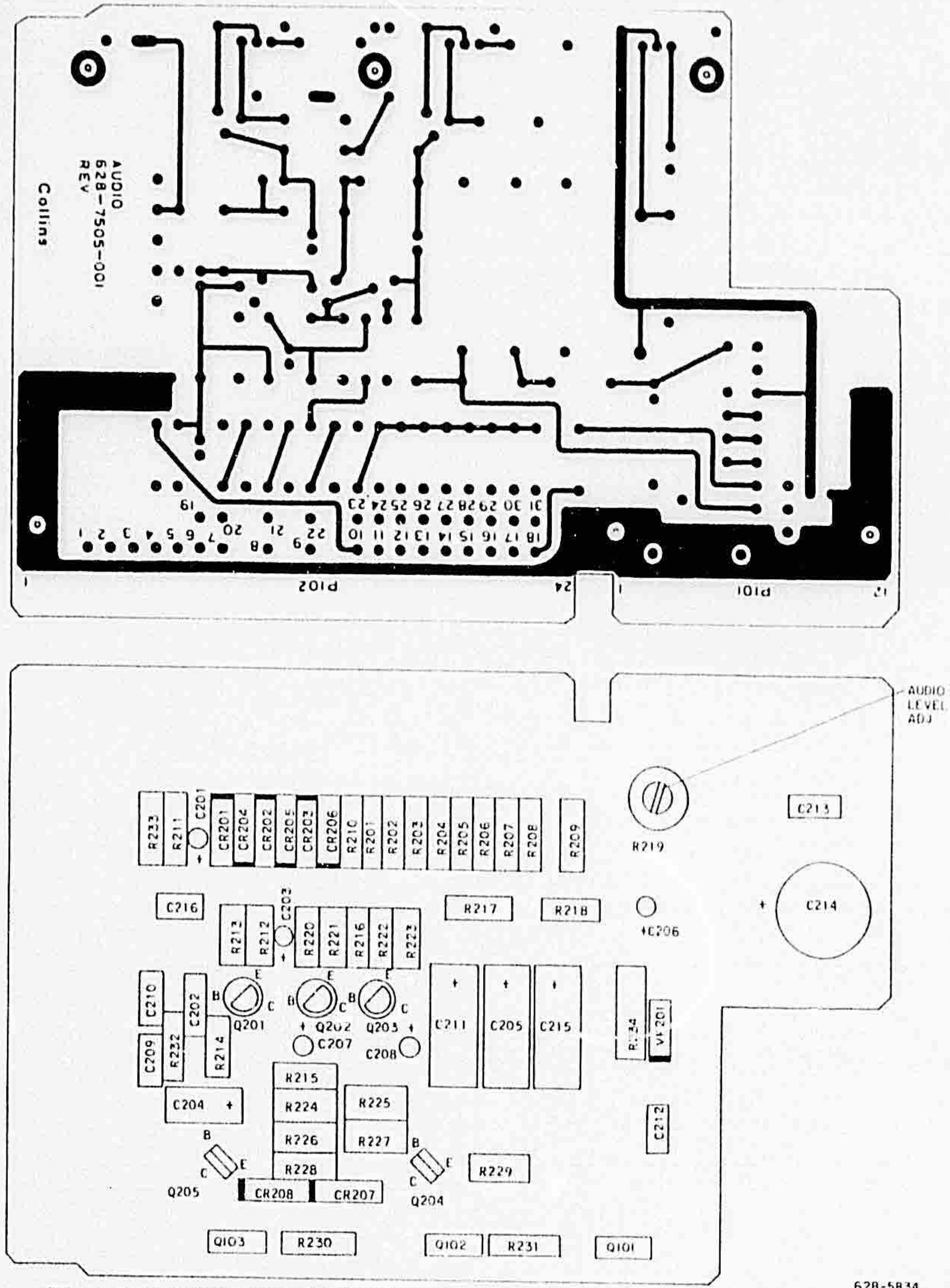
628-6635

AMR-350 Marker Board, Component Location Diagram
Figure 6-22



NOTE: DIODES CR201 AND CR204 ARE USED IN AMR-350H AND AUD-250H UNITS ONLY.

AMR-350 Audio Board, Effective Board Number 628-7505-XXX, Component Location Diagram
Figure 6-23



NOTE: DIODES CR201 AND CR204 ARE USED IN AMR-350H AND AUD-250H UNITS ONLY.

628-5834
TP4-3110-014

AMR-350 Audio Board, Effective Board Number 628-7505-XXX, Component Location Diagram
Figure 6-23

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Rearranged graphic configuration of switches S101 and S110 to actual switching sequence.	NA	NA
2	Resistors R212 and R220 were 47 kΩ, R216 was 2700 Ω. Values changed to ensure muting with diode in aircraft key line.	NA	REV C
3	Changed R214 and R232 from 33 to 34.0 kΩ and R213 from 270 to 267 Ω to stabilize audio amplifier gain.	NA	REV D

AMR-350 Audio/Marker Panel, Effective Audio Board Number 628-7505-XXX, Schematic Diagram
Figure 6-24 (Sheet A)

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C1	NOT USED	
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC 0.5PF, ±0.25PF, 50V	913-3308-010
C3	NOT USED	
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC 0.5PF, ±0.25PF, 50V	913-3308-010
C5	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC 10PF, ±0.5PF, 50V	913-3308-110
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C8	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC 33PF, ±5%, 50V	913-3308-160
C10	CAPACITOR, FIXED, CERAMIC DIELECTRIC 47PF, ±5%, 50V	913-3308-180
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC 22PF, ±5%, 50V	913-3308-140
C12	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC 22,000PF, +80-20%, 50V	913-3311-020
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC 62PF, ±5%, 50V	913-3308-190
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC 22,000PF, +80-20%, 50V	913-3311-020
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC 62PF, ±5%, 50V	913-3308-190
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C29	CAPACITOR, FIXED, PLASTIC DIELECTRIC 1000PF, ±10%, 50V	933-1409-010
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C31	CAPACITOR, FIXED, ELECTROLYTIC 47UF, +100-20%, 10V	183-1471-130
C32	CAPACITOR, FIXED, ELECTROLYTIC 47UF, +100-20%, 10V	183-1471-130
C33	CAPACITOR, FIXED, PLASTIC DIELECTRIC 33,000PF, ±5%, 50V	933-1409-060
C34	CAPACITOR, FIXED, PLASTIC DIELECTRIC 33,000PF, ±5%, 50V	933-1409-060
C35	CAPACITOR, FIXED, PLASTIC DIELECTRIC .01UF, ±5%, 50V	933-1409-050
C36	CAPACITOR, FIXED, PLASTIC DIELECTRIC .01UF, ±5%, 50V	933-1409-050
C37	CAPACITOR, FIXED, PLASTIC DIELECTRIC 3300PF, ±5%, 50V	933-1409-040
C38	CAPACITOR, FIXED, PLASTIC DIELECTRIC 3300PF, ±5%, 50V	933-1409-040
C39	CAPACITOR, FIXED, ELECTOLYTIC 10UF, +100-20%, 16V	183-1471-140
C40	CAPACITOR, FIXED, TANTALUM .47UF, ±20%, 35V	184-9113-020
C41	CAPACITOR, FIXED, TANTALUM .47UF, ±20%, 35V	184-9113-020
C42	CAPACITOR, FIXED, TANTALUM .47UF, ±20%, 35V	184-9113-020
C43	CAPACITOR, FIXED, TANTALUM .47UF, ±20%, 35V	184-9113-020
C44	CAPACITOR, FIXED, TANTALUM 2.2UF, ±20%, 15V	184-9113-200
C45	CAPACITOR, FIXED, TANTALUM 2.2UF, ±20%, 15V	184-9113-200
C46	CAPACITOR, FIXED, TANTALUM 2.2UF, ±20%, 15V	184-9113-200
C47	CAPACITOR, FIXED, ELECTROLYTIC 10UF, +100-20%, 16V	183-1471-140
C48	CAPACITOR, FIXED, ELECTROLYTIC 47UF, +100-20%, 16V	183-1471-100
C49	NOT USED	
C50	NOT USED	
C51	NOT USED	
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +89-20%, 50V	913-3311-010
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C54	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C55	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C56	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C60	NOT USED	
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC 4PF, ±0.5PF, 50V	913-3308-040
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC 1000PF, ±10%, 50V	913-3312-010
C63-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC DIELECTRIC 1500PF, ±10%, 50V	933-1409-020
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20% 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC .01UF, +80-20%, 50V	913-3311-010
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
CR1	DIODE, 1S1588	353-0450-010
CR2	DIODE, 1S1588	353-0450-010
CR3	DIODE, 1S1588	353-0450-010
CR4	NOT USED	
CR5	DIODE, 1S1588	353-0450-010

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
CR6	DIODE, 1S1588	353-0450-010
CR7	DIODE, 1S1588	353-0450-010
CR8	DIODE, 1S1588	353-0450-010
CR9	DIODE, 1S1588	353-0450-010
CR10	DIODE, 1S1588	353-0450-010
CR11	DIODE, 1S1588	353-0450-010
CR12	DIODE, 1S1588	353-0450-010
CR13	DIODE, 1S1588	353-0450-010
CR14-CR201	NOT USED	
CR202	DIODE, 1S1588	353-0450-010
CR203	DIODE, 1S1588	353-0450-010
CR204	NOT USED	
CR205	DIODE, 1S1588	353-0450-010
CR206	DIODE, 1S1588	353-0450-010
CR207	DIODE, 1S1588	353-0450-010
CR208	DIODE, 1S1588	353-0450-010
DS1	LAMP	262-1398-070
DS2	LAMP	262-1398-070
DS3	LAMP	262-1398-070
DS4-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
FL1	FILTER, BANDPASS, CRYSTAL, 10.7MHZ	293-1305-010
FL2	FILTER, BANDPASS, CRYSTAL, 10.7MHZ	293-1305-010
L1	COIL, 75MHZ	278-0420-010
L2	COIL, 75MHZ	278-0420-010
L3	COIL, 75MHZ	278-0420-010
L4	COIL, 85AC-3000A, 10.7MHZ	278-0419-010
L5	COIL, 0.22UH	240-2742-210
L6	COIL, 85AC-3000A, 10.7MHZ	278-0419-010
L7	COIL, 3.3UH	240-2742-160
L8	COIL, 3.3UH	240-2742-160
L9	COIL, 100UH	240-2742-170
L10	NOT USED	
L11	COIL, 0.68UH	240-2742-020
Q1	TRANSISTOR, 3SK35Y	352-5042-010
Q2	TRANSISTOR, 2SC 385A	352-5047-010
Q3	TRANSISTOR, 2SC982	352-5043-010
Q4	TRANSISTOR, 2SC982	352-5043-010
Q5	TRANSISTOR, 2SC982	352-5043-010
Q6	TRANSISTOR, 2SC509Y	352-5046-010
Q7	NOT USED	
Q8	TRANSISTOR, MJE-800	352-5028-010
Q9-Q100	NOT USED	

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
Q101	TRANSISTOR, 2SD234-Y	352-5041-010
Q102	TRANSISTOR, 2SD234-Y	352-5041-010
Q103	TRANSISTOR, 2SD234-Y	352-5041-010
Q104-Q200	NOT USED	
Q201	TRANSISTOR, 2SC372-Y	352-5044-010
Q202	TRANSISTOR, 2SC372-Y	352-5044-010
Q203	TRANSISTOR, 2SC372-Y	352-5044-010
Q204	TRANSISTOR, 2SC1166Y	352-5048-010
Q205	TRANSISTOR, 2SC1166Y	352-5048-010
R1	RESISTOR, FIXED, COMPOSITION 100K, 5%, 1/4W	745-7958-420
R2	RESISTOR, FIXED, COMPOSITION 100 OHMS, 5%, 1/4W	745-7958-030
R3	NOT USED	
R4	RESISTOR, FIXED, COMPOSITION 10,000 OHMS, 5%, 1/4W	745-7958-290
R5	RESISTOR, FIXED, COMPOSITION 180 OHMS, 5%, 1/4W	
R6	RESISTOR, FIXED, COMPOSITION 150 OHMS, 5%, 1/4W	745-7958-050
R7	RESISTOR, FIXED, COMPOSITION 8200 OHMS, 5%, 1/4W	745-7958-280
R8	RESISTOR, FIXED, COMPOSITION 100K, 5%, 1/4W	745-7958-420
R9	RESISTOR, FIXED, COMPOSITION 100K, 5%, 1/4W	745-7958-420
R10	NOT USED	
R11	NOT USED	
R12	RESISTOR, VARIABLE 2000 OHMS, ±20%, 0.5W	382-0500-020
R13	RESISTOR, VARIABLE 2000 OHMS, ±20%, 0.5W	382-0500-020
R14	RESISTOR, FIXED, COMPOSITION 10,000 OHMS, 5%, 1/4W	745-7958-290
R15	RESISTOR, FIXED, COMPOSITION 1000 OHMS, 5%, 1/4W	745-7958-170
R16	RESISTOR, FIXED, COMPOSITION 220 OHMS, 5%, 1/4W	745-7958-070
R17	RESISTOR, FIXED, COMPOSITION 470 OHMS, 5%, 1/4W	745-7958-120
R18	RESISTOR, FIXED, COMPOSITION 5600 OHMS, 5%, 1/4W	745-7958-260
R19	RESISTOR, FIXED, COMPOSITION 220 OHMS, 5%, 1/4W	745-7958-070
R20	RESISTOR, FIXED, COMPOSITION 820 OHMS, 5%, 1/4W	745-7958-160
R21	RESISTOR, FIXED, COMPOSITION 3900 OHMS, 5%, 1/4W	745-7958-240
R22	RESISTOR, FIXED, COMPOSITION 5600 OHMS, 5%, 1/4W	745-7958-260
R23	RESISTOR, FIXED, COMPOSITION 27,000 OHMS, 5%, 1/4W	745-7958-340
R24	RESISTOR, FIXED, COMPOSITION 56,000 OHMS, 5%, 1/4W	745-7958-390
R25	RESISTOR, FIXED, COMPOSITION 1000 OHMS, 5%, 1/4W	745-7958-170
R26	RESISTOR, VARIABLE 10,000 OHMS, ±20%, 1/4W	382-0500-030
R27	RESISTOR, FIXED, COMPOSITION 3300 OHMS, 5%, 1/4W	745-7958-230
R28	RESISTOR, FIXED, COMPOSITION 4700 OHMS, 5%, 1/4W	745-7958-250
R29	RESISTOR, FIXED, FILM 12,100 OHMS, ±1%, 1/8W	745-7957-310
R30	RESISTOR, FIXED, FILM 97,600 OHMS, ±1%, 1/8W	745-7403-190
R31	RESISTOR, FIXED, FILM 1820 OHMS, ±1%, 1/8W	745-7956-510
R32	RESISTOR, FIXED, COMPOSITION 100K, 5%, 1/4W	745-7958-420
R33	RESISTOR, FIXED, FILM 10,000 OHMS, ±1%, 1/8W	745-7957-230
R34	RESISTOR, FIXED, FILM 97,600 OHMS, ±1%, 1/8W	745-7403-190
R35	RESISTOR, FIXED, FILM 1620 OHMS, ±1%, 1/8W	745-7956-460

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R36	RESISTOR, FIXED, COMPOSITION 100K, 5%, 1/4W	745-7958-420
R37	RESISTOR, FIXED, FILM 15,000 OHMS, ±1%, 1/8W	745-7957-400
R38	RESISTOR, FIXED, FILM 130,000 OHMS, ±1%, 1/8W	745-7403-310
R39	RESISTOR, FIXED, FILM 2100 OHMS, ±1%, 1/8W	745-7956-570
R40	RESISTOR, FIXED, COMPOSITION 100K, 5%, 1/4W	745-7958-420
R41	RESISTOR, FIXED, COMPOSITION 470 OHMS, 5%, 1/4W	745-7958-120
R42	RESISTOR, FIXED, COMPOSITION 1MEGO, 5%, 1/4W	745-7958-520
R43	RESISTOR, FIXED, COMPOSITION 47,000 OHMS, 5%, 1/4W	745-7958-370
R44	RESISTOR, FIXED, COMPOSITION 120 OHMS, 5%, 1/4W	745-7958-040
R45	RESISTOR, VARIABLE 10,000 OHMS, ±20%, 0.5W	382-0500-030
R46	RESISTOR, FIXED, COMPOSITION 0.47 OHM, 5%, 1/4W	745-7958-500
R47	RESISTOR, FIXED, COMPOSITION 5600 OHMS, 5%, 1/4W	745-7958-260
R48	RESISTOR, FIXED, COMPOSITION 47,000 OHMS, 5%, 1/4W	745-7958-370
R49	RESISTOR, FIXED, COMPOSITION 47,000 OHMS, 5%, 1/4W	745-7958-370
R50	RESISTOR, FIXED, COMPOSITION 47,000 OHMS, 5%, 1/4W	745-7958-370
R51	RESISTOR, FIXED, COMPOSITION 10,000 OHMS, 5%, 1/4W	745-7958-290
R52	RESISTOR, FIXED, COMPOSITION 10,000 OHMS, 5%, 1/4W	745-7958-290
R53	NOT USED	
R54	RESISTOR, FIXED, COMPOSITION 3.3 OHMS, 10%, 1/2W	745-7951-260
R55	NOT USED	
R56	RESISTOR, FIXED, COMPOSITION 220 OHMS, 5%, 1/4W	745-7958-070
R57	RESISTOR, FIXED, COMPOSITION 1200 OHMS, 5%, 1/4W	745-7958-180
R58	RESISTOR, FIXED, COMPOSITION 5600 OHMS, 5%, 1/4W	745-7958-260
R59	RESISTOR, FIXED, COMPOSITION 680 OHMS, 5%, 1/4W	745-7958-150
R60-R200	NOT USED	
R201	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R202	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R203	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R204	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R205	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R206	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R207	RESISTOR, FIXED, COMPOSITION 510 OHMS, 5%, 1/4W	745-7958-130
R208	RESISTOR, FIXED, COMPOSITION 390 OHMS, 5%, 1/4W	745-7958-100
R209	RESISTOR, FIXED, COMPOSITION 120 OHMS, 5%, 1/4W	745-7958-040
R210	RESISTOR, FIXED, COMPOSITION 8200 OHMS, 5%, 1/4W	745-7958-280
R211	RESISTOR, FIXED, COMPOSITION 22,000 OHMS, 5%, 1/4W	745-7958-330
R212	RESISTOR, FIXED, COMPOSITION, 68K, 10%, 1/4W (EFF REV C)	745-7950-470
R212	RESISTOR, FIXED, COMPOSITION 47,000 OHMS, 5%, 1/4W	745-7958-370

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

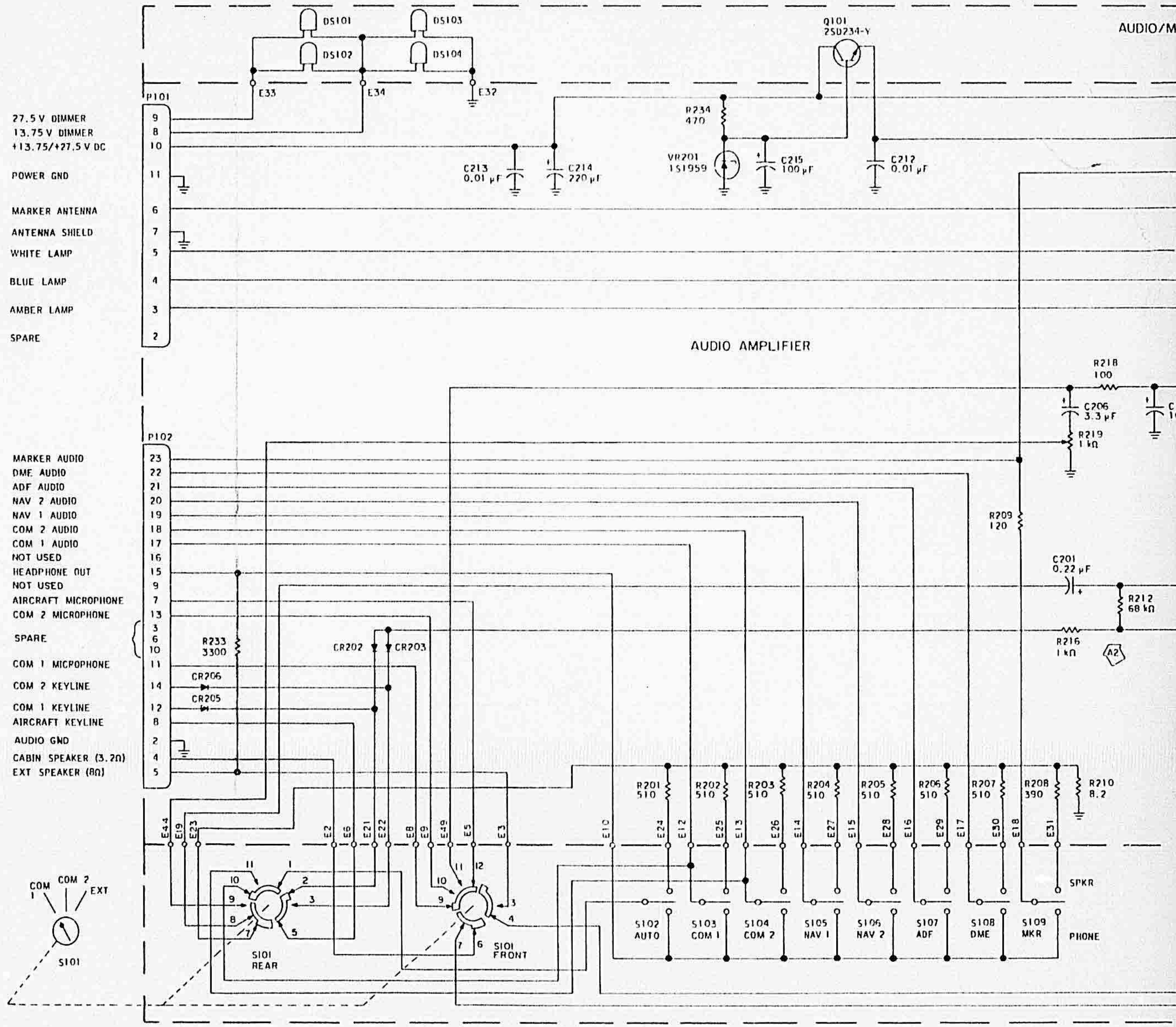
SYMBOL	DESCRIPTION	PART NUMBER
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W (EFF REV D)	745-7955-700
R213	RESISTOR, FIXED, COMPOSITION 270 OHMS, 5%, 1/4W	745-7958-080
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R214	RESISTOR, FIXED, COMPOSITION 33,000 OHMS, 5%, 1/4W	745-7958-350
R215	RESISTOR, FIXED, COMPOSITION 33,000 OHMS, 5%, 1/4W	745-7958-350
R216	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W (EFF REV C)	745-7950-250
R216	RESISTOR, FIXED, COMPOSITION 2700 OHMS, 5%, 1/4W	745-7958-220
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, 5%, 1/4W	745-7958-040
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, 5%, 1/4W	745-7958-030
R219	RESISTOR, VARIABLE 1K, 1/2W	382-0045-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W (EFF REV C)	745-7950-420
R220	RESISTOR, FIXED, COMPOSITION 47,000 OHMS, 5%, 1/4W	745-7958-370
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, 5%, 1/4W	745-7958-260
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, 5%, 1/4W	745-7958-070
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, 5%, 1/4W	745-7958-070
R224	RESISTOR, FIXED, COMPOSITION 39,000 OHMS, 5%, 1/4W	745-7958-360
R225	RESISTOR, FIXED, COMPOSITION 39,000 OHMS, 5%, 1/4W	745-7958-360
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, 5%, 1/4W	745-7958-120
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, 5%, 1/4W	745-7958-120
R228	RESISTOR, FIXED, COMPOSITION 470 OHMS, 5%, 1/4W	745-7958-120
R229	RESISTOR, FIXED, COMPOSITION 470 OHMS, 5%, 1/4W	745-7958-120
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHM, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHM, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R232	RESISTOR, FIXED, COMPOSITION 33K, 5%, 1/4W	745-7958-350
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, 5%, 1/4W	745-7958-230
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
S1-S100	NOT USED	
S101	SWITCH, WAFER	259-1024-020
S102	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S103	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S104	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090

*PART NUMBERS ARE SWITCH/LEVER CAP.

PARTS LIST
AMR-350 AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-001 AND 628-7605-002

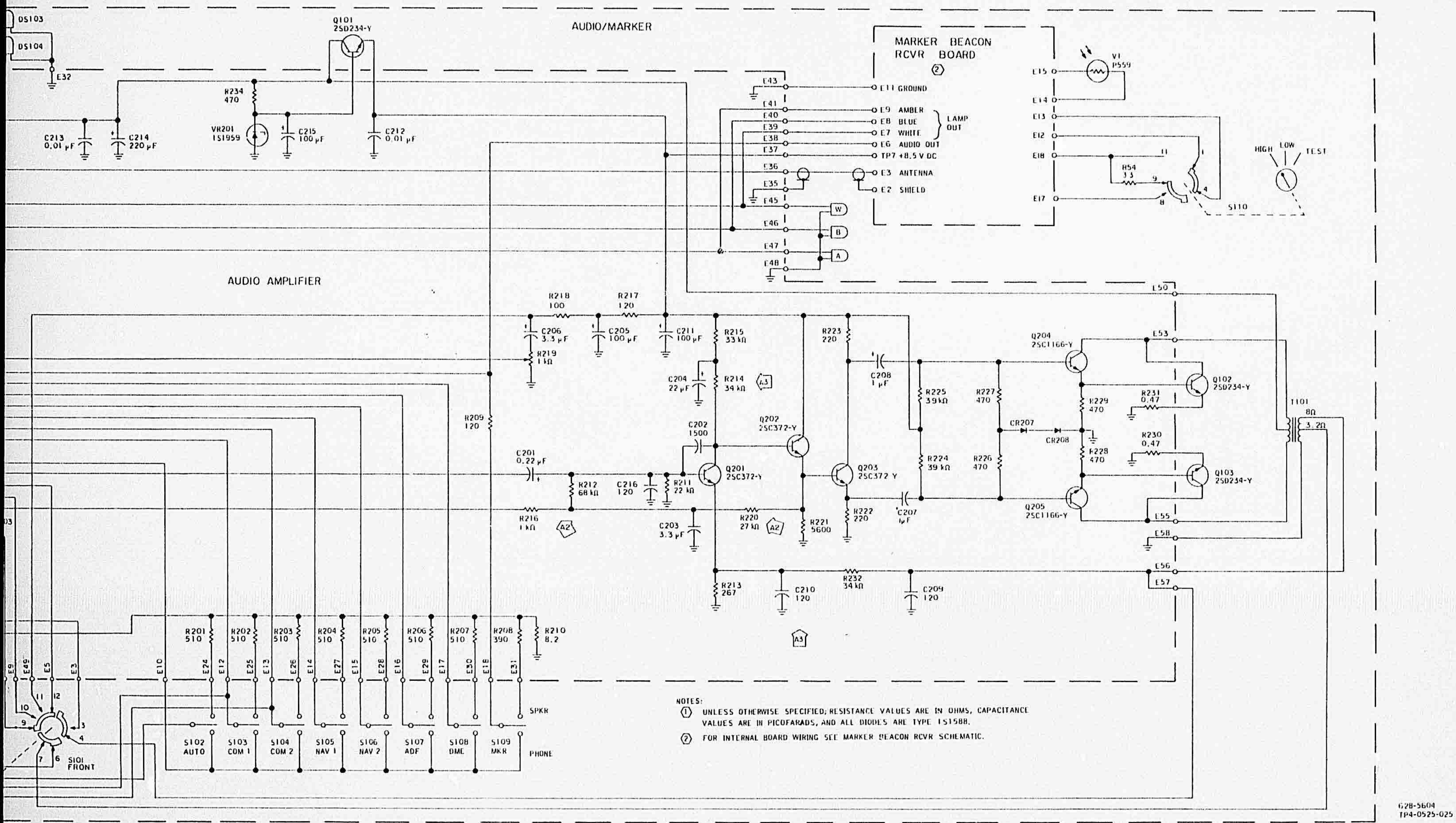
SYMBOL	DESCRIPTION	PART NUMBER
S105	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S106	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S107	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S108	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S109	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S110	SWITCH, WAFER	259-1024-010
U1	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U2	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U3	INTEGRATED CIRCUIT, MC1458CP1	351-1156-020
U4	INTEGRATED CIRCUIT, MC3401P	351-1611-010
VR1	ZENER DIODE, RD5A-N	353-3740-210
VR2-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130
Y1	CRYSTAL UNIT, QUARTZ, 85.7 MHZ	289-7260-020

*PART NUMBERS ARE SWITCH/LEVER CAP.



SEE BLOW-UP FICHE NO. CRL103 - ITEM S

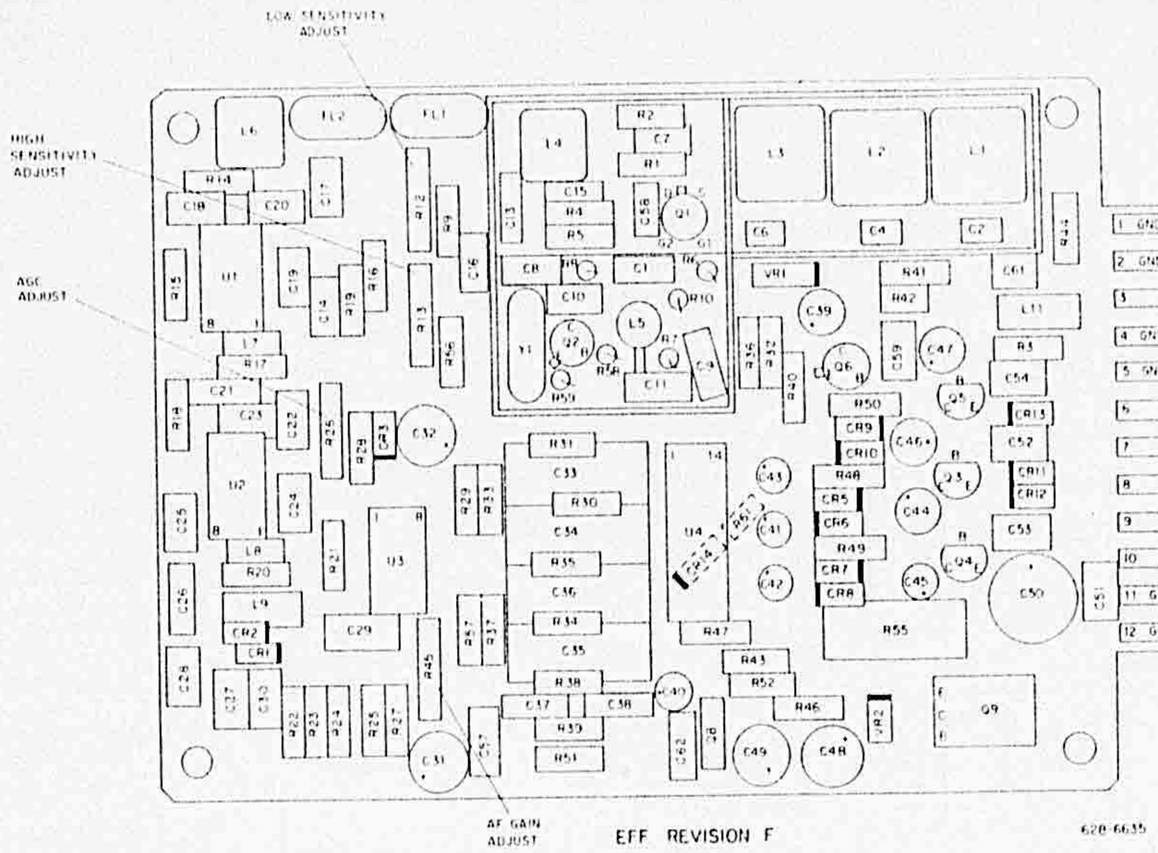
6-83



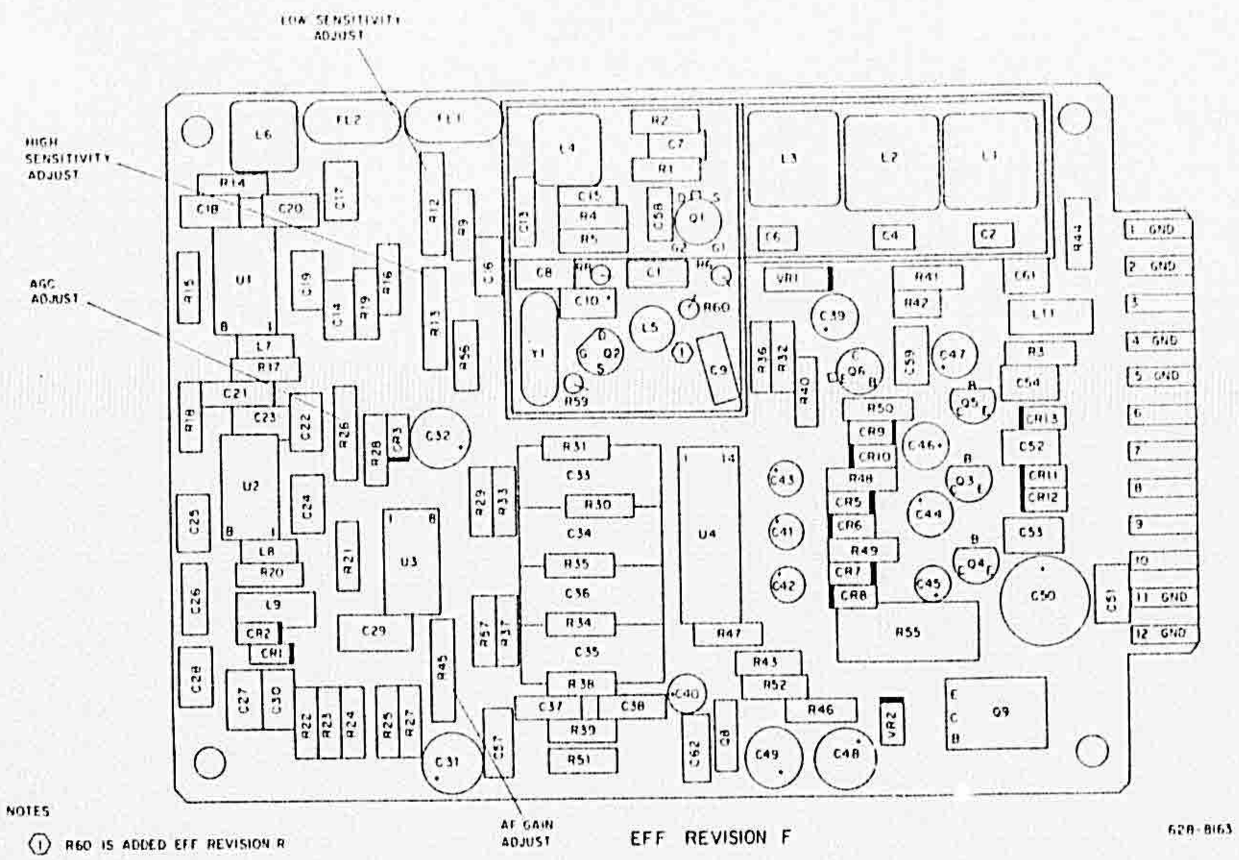
AMR-350 Audio/Marker Panel, Effective Audio Board Number 628-7505-XXX, Schematic Diagram
Figure 6-24

Revised 9 June 1982

SEE BLOW-UP FICHE NO. CRL103 - ITEM T



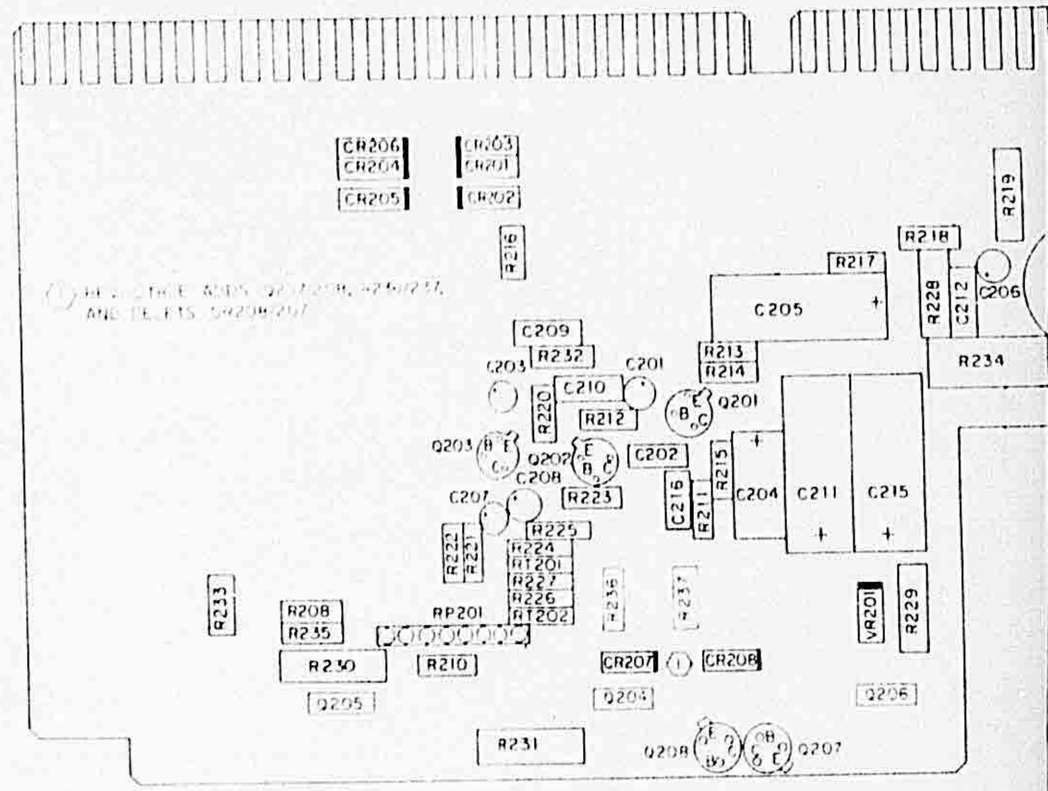
AMR-350H Marker Board, Component Location Diagram (Effective Revision F to P)
Figure 25



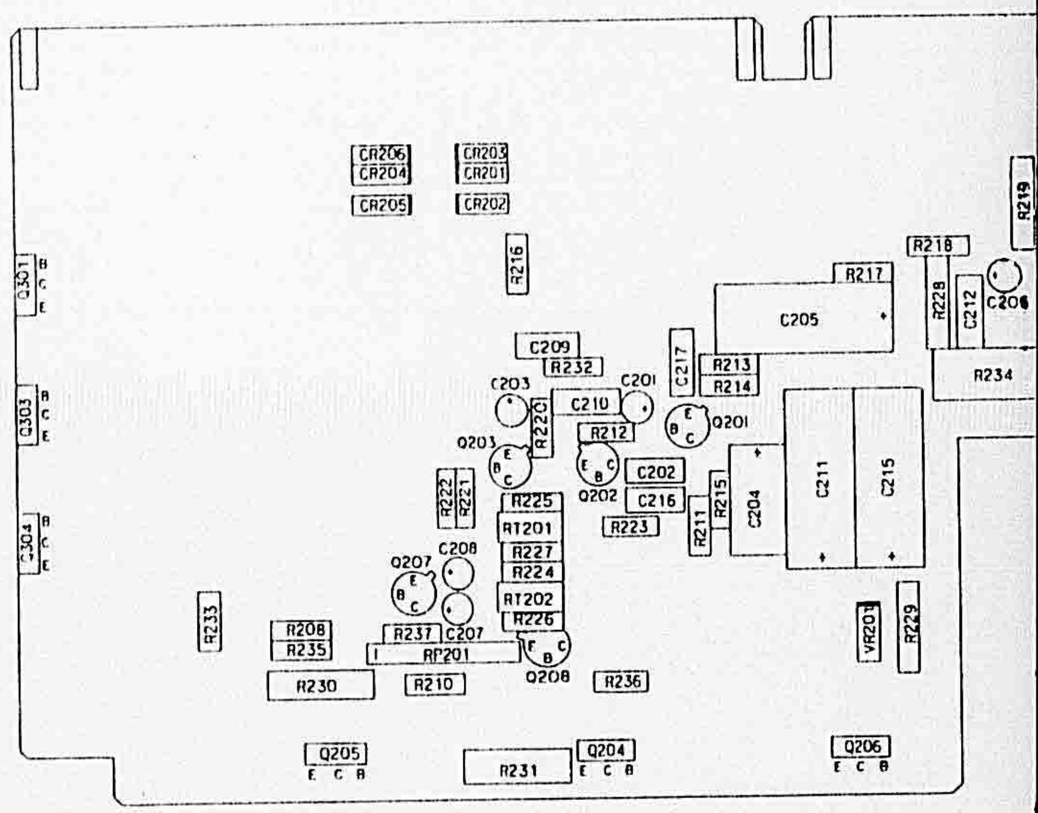
NOTES

(1) R60 IS ADDED EFF REVISION R

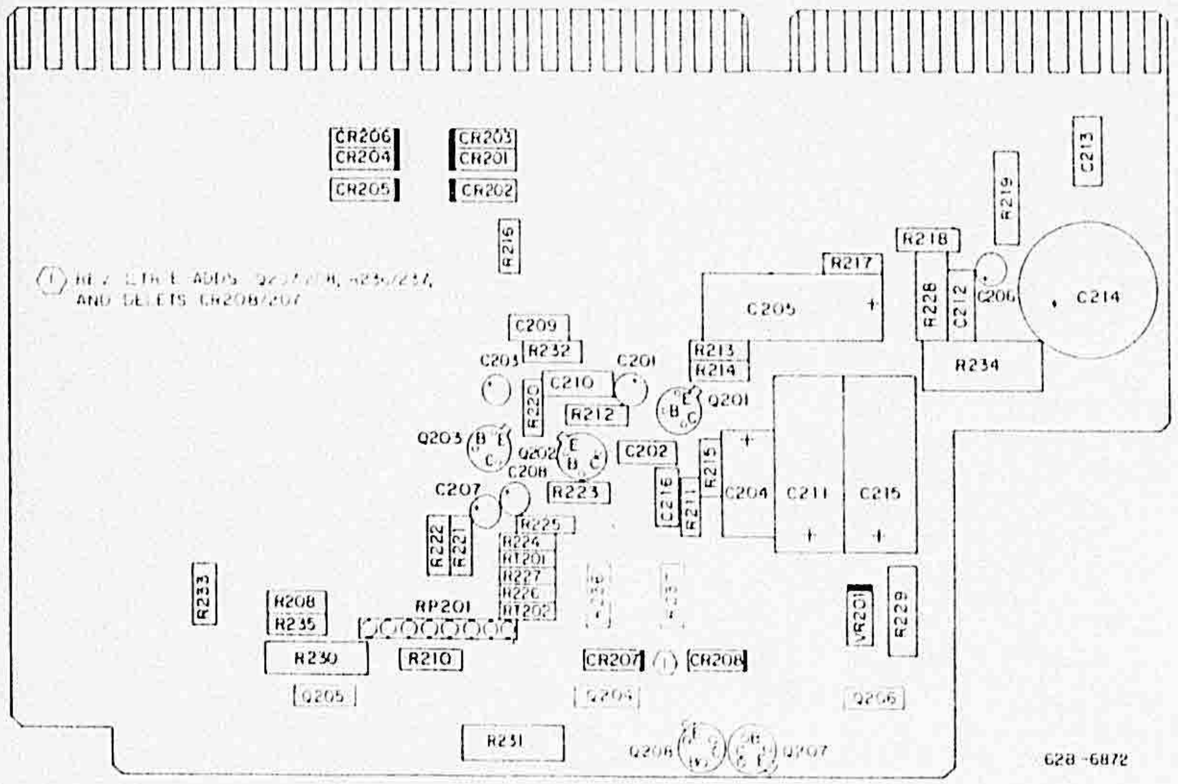
AMR-350H Marker Board, Component Location Diagram (Effective Revision P)
Figure 6-25A



AMR-350H Audio Board, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-26

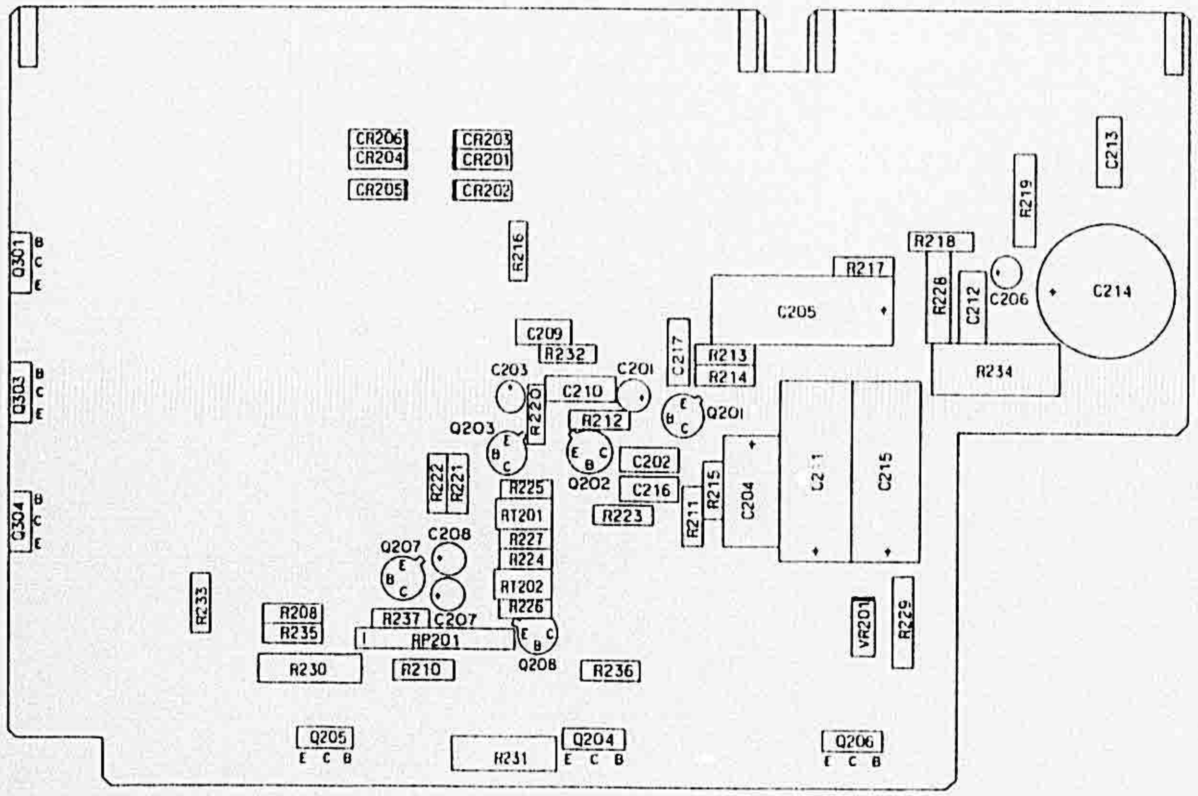


AMR-350H Audio Board, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-27



628-6872

AMR-450H Audio Board, Effective Board Number 628-6114-001, Component Location Diagram
Figure 6-26



628-7661

AMR-450H Audio Board, Effective Board Number 628-6114-002, Component Location Diagram
Figure 6-27

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Changed value of R213 from 267 to 249 Ω, R226 and R227 from 470 Ω to 1 kΩ; changed R224 and R225 from 22 kΩ to test select components; added RT201 and RT202. Changes prevent thermal runaway in 27.5-V installations.	SB 2	REV D
2	Added Q207, Q208, R236, and R237. Changed Q204 and Q205 from MJE800 to MJE521. Changes prevent thermal runaway. Refer to schematic apron for diagram of affected area prior to revision E.	NA	REV E
C	Added C217 to prevent no-load oscillation.	NA	REV H
D	Changed Q204 and Q205 from MJE 521 to 2N5191 to improve reliability.	NA	REV W
E	Changed CR201 and CR204 from 1N4454 to 1N4003 to improve reliability.	NA	REV L
G, Marker receiver schematic	Changed R51 from 10 to 6.34 kΩ, R52 from 10% to 1% part. Added CR14, R61.	SB 7	REV T

AMR-350H Audio/Marker Panel, Effective Audio Board Number 628-6114-XXX, Schematic Diagram
Figure 6-28 (Sheet A)

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C1	CAPACITOR, FIXED, MICA DIELECTRIC, 5PF ±1/2PF, 300V	912-2106-090
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C3	NOT USED	
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C5	NOT USED	
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C8	CAPACITOR, FXD, MICA DIEL, 68PF, ±5PF, 300V (EFF REV P; SB 6)	912-2099-250
C8	CAPACITOR, FIXED, MICA DIEL, 120PF, 5%, 300V (EFF REV L; SB 3)	912-2106-150
C8	CAPACITOR, FIXED, MICA DIELECTRIC, 150PF, ±5%, 300V	912-2106-100
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C10	CAPACITOR, FXD, MICA DIEL, 12PF, ±1/2PF, 300V (EFF REV T; SB 6)	912-2099-100
C10	CAPACITOR, FIXED, MICA DIELECTRIC, 10PF, ±1/2PF, 300V	912-2106-020
C11	NOT USED (EFF REV P; SB 6)	
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C12	NOT USED	
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190

Revised 9 June 1982

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C29	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 1000PF, +80-20%, 500V	913-3298-110
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C31	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C32	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C33	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-160
C34	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-160
C35	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.01UF, ±5%, 100V	933-1404-150
C36	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.01UF, ±5%, 100V	933-1404-150
C37	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-140
C38	CAPACITOR, FIXED, POLYESTER DIELECTRIC, 0.033UF, ±5%, 100V	933-1404-140
C39	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C40	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C41	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C42	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C43	CAPACITOR, FIXED, TANTALUM, 0.47UF, ±20%, 35V	184-9113-020
C44	CAPACITOR, FIXED, TANTALUM, 10UF, ±20%, 20V	184-9113-070
C45	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C46	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C47	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C48	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 16V	183-1471-100

Revised 9 June 1982

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C49	CAPACITOR, FIXED, ELECTROLYTIC, 33UF, +100-20%, 16V	183-1471-040
C50	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 35V	183-1471-190
C51	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.047UF, 20%, 50V	913-3306-060
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C54	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C55	NOT USED	
C56	NOT USED	
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05UF, +80-20%, 12V	913-3298-010
C60	NOT USED	
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.05PF, +80-20%, 12V	913-3298-010
C63-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC, DIELECTRIC 1500PF, ±5%, 100V	933-1404-120
C203	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC 0.01 UF, +80-20%, 50V	913-3298-130
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC 0.01 UF, +80-20%, 50V	913-3298-130

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C214	CAPACITOR, FIXED, ELECTROLYTIC 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC 120PF, ±5%, 50V	913-3308-210
C217	CAPACITOR, FXD, CF[illegible] DIEL, 680PF, 20%, 1000V (EFF REV H)	913-1194-000
CR1	DIODE, 1N4454	353-3741-010
CR2	DIODE, 1N4454	353-3741-010
CR3	DIODE, 1N4454	353-3741-010
CR4	NOT USED	
CR5	DIODE, 1N4454	353-3741-010
CR6	DIODE, 1N4454	353-3741-010
CR7	DIODE, 1N4454	353-3741-010
CR8	DIODE, 1N4454	353-3741-010
CR9	DIODE, 1N4454	353-3741-010
CR10	DIODE, 1N4454	353-3741-010
CR11	DIODE, 1N4454	353-3741-010
CR12	DIODE, 1N4454	353-3741-010
CR13	DIODE, 1N4454	353-3741-010
CR14	DIODE, 1N4454 (EFF REV T, SB 7)	
CR15-CR200	NOT USED	
CR201	DIODE, 1N4003 (EFF REV L)	353-6442-030
CR201	DIODE, 1N4454	353-3741-010
CR202	DIODE, 1N4454	353-3741-010
CR203	DIODE, 1N4454	353-3741-010
CR204	DIODE, 1N4003 (EFF REV L)	353-6442-030
CR204	DIODE, 1N4454	353-3741-010
CR205	DIODE, 1N4454	353-3741-010
CR206	DIODE, 1N4454	353-3741-010
CR207	NOT USED (EFF REV E)	
CR207	DIODE, 1N4454	353-3741-010
CR208	NOT USED (EFF REV E)	
CR208	DIODE, 1N4454	353-3741-010
DS1	LAMP	262-1398-070
DS2	LAMP	262-1398-070
DS3	LAMP	262-1398-070
DS4-DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
FL1	FILTER, BANDPASS, CRYSTAL, 10.7MHz	293-1305-010
FL2	FILTER, BANDPASS, CRYSTAL, 10.7MHz	293-1305-010
L1	COIL, 75MHz	278-0420-010
L2	COIL, 75MHz	278-0420-010
L3	COIL, 75MHz	278-0420-010

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
L4	COIL, 10.7MHz	278-0419-010
L5	COIL, VARIABLE	242-0438-010
L6	COIL, 10.7MHz	278-0419-010
L7	COIL, 3.3UH	240-2742-160
L8	COIL, 3.3UH	240-2742-160
L9	COIL, 100UH	240-2742-170
L10	NOT USED	
L11	COIL, 0.68UH	240-2742-020
Q1	TRANSISTOR, 40841	352-5005-010
Q2	TRANSISTOR, MPF820 (EFF REV P; SB 6)	352-5013-030
Q2	TRANSISTOR, 2N918	352-5027-020
Q3	TRANSISTOR, MPS A-14	352-5035-010
Q4	TRANSISTOR, MPS A-14	352-5035-010
Q5	TRANSISTOR, MPS A-14	352-5035-010
Q6	TRANSISTOR, 2N2222A	353-5021-010
Q7	NOT USED	
Q8	TRANSISTOR, MJE-800	352-5028-010
Q9	TRANSISTOR, MJE-182	352-5011-010
Q10-Q200	NOT USED	
Q201	TRANSISTOR, 2N2222	352-5021-010
Q202	TRANSISTOR, 2N2222	352-5021-010
Q203	TRANSISTOR, 2N2222	352-5021-010
Q204	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q204	TRANSISTOR, MJE 521 (EFF REV E)	352-5064-010
Q204	TRANSISTOR, MJE 800	352-5028-010
Q205	TRANSISTOR, 2N5191 (EFF REV W)	352-0924-020
Q205	TRANSISTOR, MJE 521 (EFF REV E)	352-5064-010
Q205	TRANSISTOR, MJE 800	352-5028-010
Q206	TRANSISTOR, MJE 182	352-5011-010
Q207	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
Q208	TRANSISTOR, 2N2222 (EFF REV E)	352-5021-010
R1	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R2	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 10%, 1/4W	745-7950-130
R3	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 10%, 1/4W	745-7950-140
R4	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 10%, 1/4W	745-7950-370
R5	RESISTOR, FIXED, COMPOSITION, 180 OHMS, 10%, 1/4W	745-7950-160
R6	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 10%, 1/4W	745-7950-130
R7	NOT USED (EFF REV P; SB 6)	
R7	RESISTOR, FIXED, COMPOSITION, 1.5K 10%, 1/4W (EFF REV L; SB 3)	745-7950-270
R7	RESISTOR, FIXED, COMPOSITION, 15K, 10%, 1/4W	745-7950-390
R8	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R9	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R10	NOT USED (EFF REV P; SB 6)	
R10	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R11	NOT USED	

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R12	RESISTOR, VARIABLE, 10K, ±20%, 0.5W	382-0045-030
R13	RESISTOR, VARIABLE, 10K, ±20%, 0.5W	382-0045-030
R14	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R15	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R16	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R17	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R18	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R19	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R20	RESISTOR, FIXED, COMPOSITION, 820 OHMS, 10%, 1/4W	745-7950-240
R21	RESISTOR, FIXED, COMPOSITION, 3.9K, 10%, 1/4W	745-7950-320
R22	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R23	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R24	RESISTOR, FIXED, COMPOSITION, 82K, 10%, 1/4W (EFF REV L)	745-7950-480
R24	RESISTOR, FIXED, COMPOSITION, 56K, 10%, 1/4W	745-7950-460
R25	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R26	RESISTOR, VARIABLE, 10K, 30%, 0.1W	382-0049-050
R27	RESISTOR, FIXED, COMPOSITION, 3.3K, 10%, 1/4W	745-7950-310
R28	RESISTOR, FIXED, COMPOSITION, 4.7K, 10%, 1/4W	745-7950-330
R29	RESISTOR, FIXED, FILM, 12,100 OHMS, ±1%, 1/8W	745-7957-310
R30	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R31	RESISTOR, FIXED, FILM, 1820 OHMS, ±1%, 1/8W	745-7956-510
R32	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R33	RESISTOR, FIXED, FILM, 10,000 OHMS, ±1%, 1/8W	745-7957-230
R34	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R35	RESISTOR, FIXED, FILM, 1620 OHMS, ±1%, 1/8W	745-7956-460
R36	RESISTOR, FIXED, COMPOSITION, 100K, 10%, 1/4W	745-7950-490
R37	RESISTOR, FIXED, FILM, 15,000 OHMS, ±1%, 1/8W	745-7957-400
R38	RESISTOR, FIXED, FILM, 130,000 OHMS, ±1%, 1/8W	745-7403-310
R39	RESISTOR, FIXED, FILM, 2100 OHMS, ±1%, 1/8W	745-7956-570
R40	RESISTOR, FIXED, FILM, 130K, 1%, 1/8W	745-7403-310
R41	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W	745-7950-210
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 560K, 10%, 1/4W	745-7950-580
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 680K, 10%, 1/4W	745-7950-590
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 820K, 10%, 1/4W	745-7950-600
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1M, 10%, 1/4W	745-7950-610
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1.2M, 10%, 1/4W	745-7950-620
R42	TEST SELECT RESISTOR, FIXED COMPOSITION, 1.5M, 10%, 1/4W	745-7950-630
R43	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R44	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R45	RESISTOR, VARIABLE, 10K, 30%, 0.1W	382-0049-050
R46	RESISTOR, FIXED, COMPOSITION, 470K, 10%, 1/4W	745-7950-570
R47	RESISTOR, FIXED, COMPOSITION, 5.6K, 10%, 1/4W	745-7950-340
R48	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R49	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R50	RESISTOR, FIXED, COMPOSITION, 47K, 10%, 1/4W	745-7950-450
R51	RESISTOR, FXD, FILM, 10K, 1%, 1/8W (EFF REV T; SB 7)	705-1044-000
R51	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R52	RESISTOR, FXD, FILM, 6.34K, 1%, 1/8W (EFF REV T; SB 7)	705-3605-380
R52	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R53	NOT USED	
R54	NOT USED	
R55	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±10%, 1W	745-7952-210
R56	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 10%, 1/4W	745-7950-170
R57	RESISTOR, FIXED, COMPOSITION, 1.2K, 10%, 1/4W	745-7950-260
R58	NOT USED (EFF REV P; SB 6)	
R58	RESISTOR, FIXED, COMPOSITION, 1.8K, 10%, 1/4W (EFF REV L; SB 3)	745-7950-280
R58	RESISTOR, FIXED, COMPOSITION, 18K, 10%, 1/4W	745-7950-400
R59	RESISTOR, FIXED, COMPOSITION, 680 OHMS, 10%, 1/4W	745-7950-230
R60	NOT USED	
R61	RESISTOR, FXD, CMPSN, 47K, 10%, 1/4W (EFF REV T; SB 7)	745-7950-450
R62-R207	NOT USED	
R208	RESISTOR, FIXED, COMPOSITION 510 OHMS, ±5%, 1/4W	745-7958-130
R209	NOT USED	
R210	RESISTOR, FIXED, COMPOSITION 8.2 OHMS, ±5%, 1/4W	745-7958-010
R211	RESISTOR, FIXED, COMPOSITION 22K, 10%, 1/4W	745-7950-410
R212	RESISTOR, FIXED, COMPOSITION, 68K, 10%, 1/4W	745-7950-470
R213	RESISTOR, FIXED, FILM, 249 OHMS, 1%, 1/8W (EFF REV D; SB 2)	745-7955-670
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W	745-7955-700
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R215	RESISTOR, FIXED, COMPOSITION 33K, ±10%, 1/4W	745-7950-430
R216	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W	745-7950-250
R217	RESISTOR, FIXED, COMPOSITION 120 OHMS, ±10%, 1/4W	745-7950-140
R218	RESISTOR, FIXED, COMPOSITION 100 OHMS, ±10%, 1/4W	745-7950-130
R219	RESISTOR, VARIABLE 1K, ±30%, 0.1W	382-0500-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W	745-7950-420
R221	RESISTOR, FIXED, COMPOSITION 5600 OHMS, ±10%, 1/4W	745-7950-340
R222	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R223	RESISTOR, FIXED, COMPOSITION 220 OHMS, ±10%, 1/4W	745-7950-170
R224	TEST SELECT VALUES (EFF REV G)	
R224	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R224	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R224	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R224	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R224	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R224	TEST SELECT (EFF REF D; SB 2)	
R224	RESISTOR, FIXED, COMPOSITION 22K, ±10%, 1/4W	745-7950-410
R225	TEST SELECT VALUES (EFF REV G)	
R225	RESISTOR, FXD, CMPSN, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FXD, CMPSN, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FXD, CMPSN, 22K, 10%, 1/4W	745-7950-410
R225	RESISTOR, FXD, CMPSN, 33K, 10%, 1/4W	745-7950-430
R225	RESISTOR, FXD, CMPSN, 39K, 10%, 1/4W	745-7950-440
R225	RESISTOR, FIXED, COMPOSITION, 10K, 10%, 1/4W	745-7950-370
R225	RESISTOR, FIXED, COMPOSITION, 15K, 10%, 1/4W	745-7950-390
R225	RESISTOR, FIXED, COMPOSITION, 22K, 10%, 1/4W	745-7950-410
R226	RESISTOR, FIXED, COMPOSITION 1K, 10%, 1/4W (EFF REV D; SB 2)	745-7950-250
R226	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R227	RESISTOR, FIXED, COMPOSITION 470 OHMS, ±10%, 1/4W	745-7950-210
R228	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R229	RESISTOR, VARIABLE, 20K ±30%, 0.1W	382-0500-040
R230	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND 0.47 OHMS, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W	745-7957-740
R233	RESISTOR, FIXED, COMPOSITION 3300 OHMS, ±10%, 1/4W	745-7950-310
R234	RESISTOR, FIXED, COMPOSITION 470 OHMS, 10%, 1W	745-7952-210
R235	RESISTOR, FIXED, COMPOSITION, 510 OHMS ±5%, 1/8W	745-7958-130
R235	NOT USED	
R236	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
R237	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1/4W (EFF REV E)	745-7950-210
RP1-RP200	NOT USED	
RP201	RESISTOR NETWORK, 500 OHMS ±5%, 1/8W	350-4000-080
RT1-RT200	NOT USED	
RT201	RESISTOR, THERMAL, NEG COEFF, 1K, 10%, 1/2W (EFF REV D; SB 2)	714-3255-010
S1	SWITCH TOGGLE	266-5417-020
S2-S100	NOT USED	
S101	SWITCH, WAFER, 3 POS	259-1024-110
S102	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140

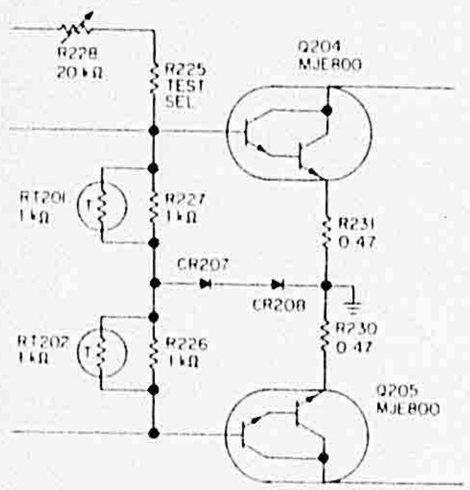
*PART NUMBERS ARE SWITCH/LEVER CAP.

Revised 9 June 1982

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-6113-003 AND 628-7605-002

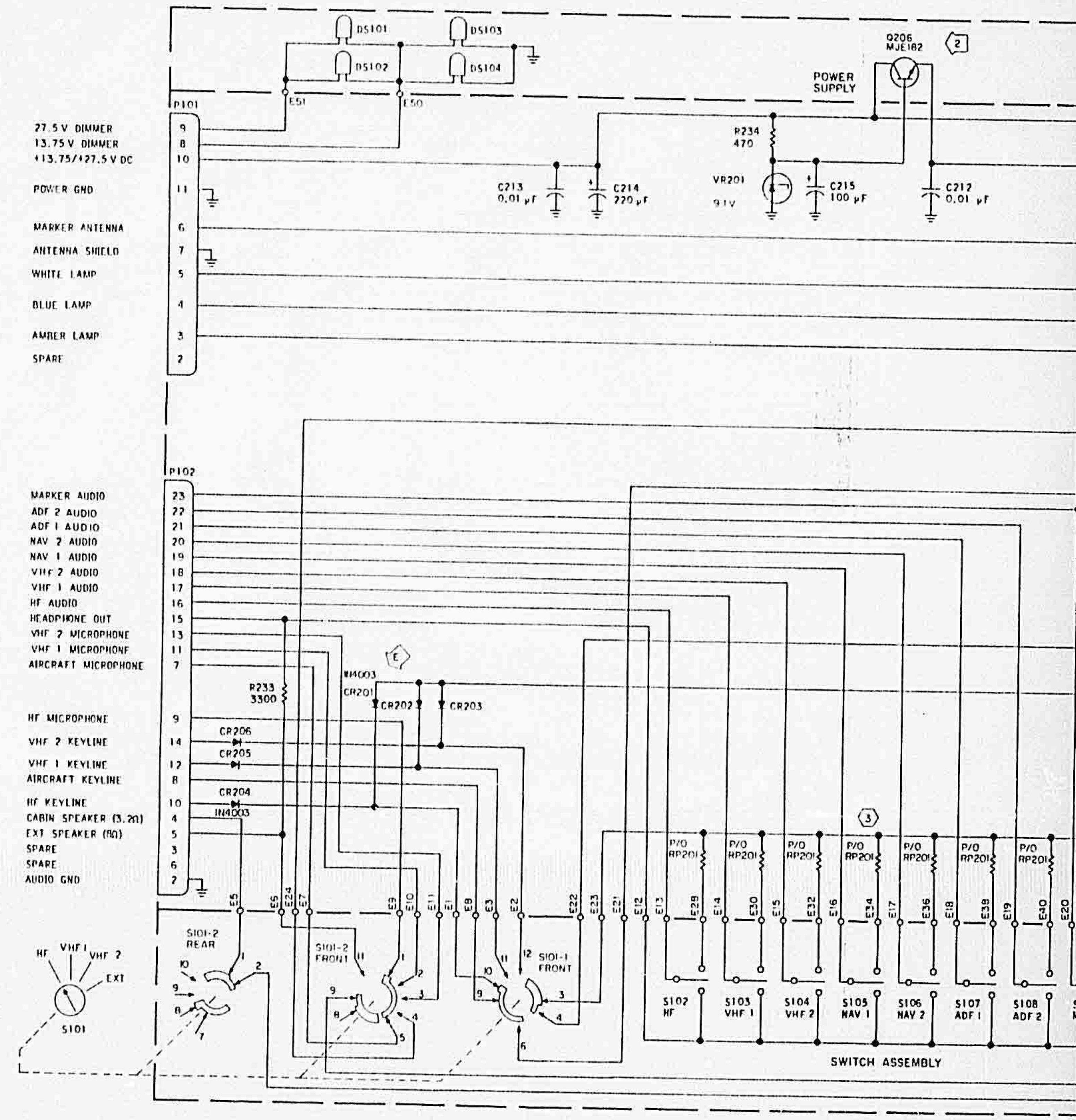
SYMBOL	DESCRIPTION	PART NUMBER
S103	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S104	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S105	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S106	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S107	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S108	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S109	SWITCH, TOGGLE/CAP	*628-7373-001/ 266-5417-090 OR *266-5417-130/ 266-5417-140
S110	SWITCH, 3 POSITION	259-1024-090
T1-T100	NOT USED	
T101	TRANSFORMER, AUDIO	667-0256-010
U1	INTEGRATED CIRCUIT, 1350P	351-1134-010
U2	INTEGRATED CIRCUIT, 1350P	351-1134-010
U3	INTEGRATED CIRCUIT, 1458CP1	351-1156-020
U4	INTEGRATED CIRCUIT, 3401P	351-1611-010
V1	PHOTOCELL	353-0449-010
VR1	ZENER DIODE, 1N5231B	353-3740-210
VR2	ZENER DIODE, 1N4739A	353-3737-130
VR3-VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130
Y1	CRYSTAL, QUARTZ, 85.70MHZ	289-7260-020

*PART NUMBERS ARE SWITCH/LEVEL CAP.



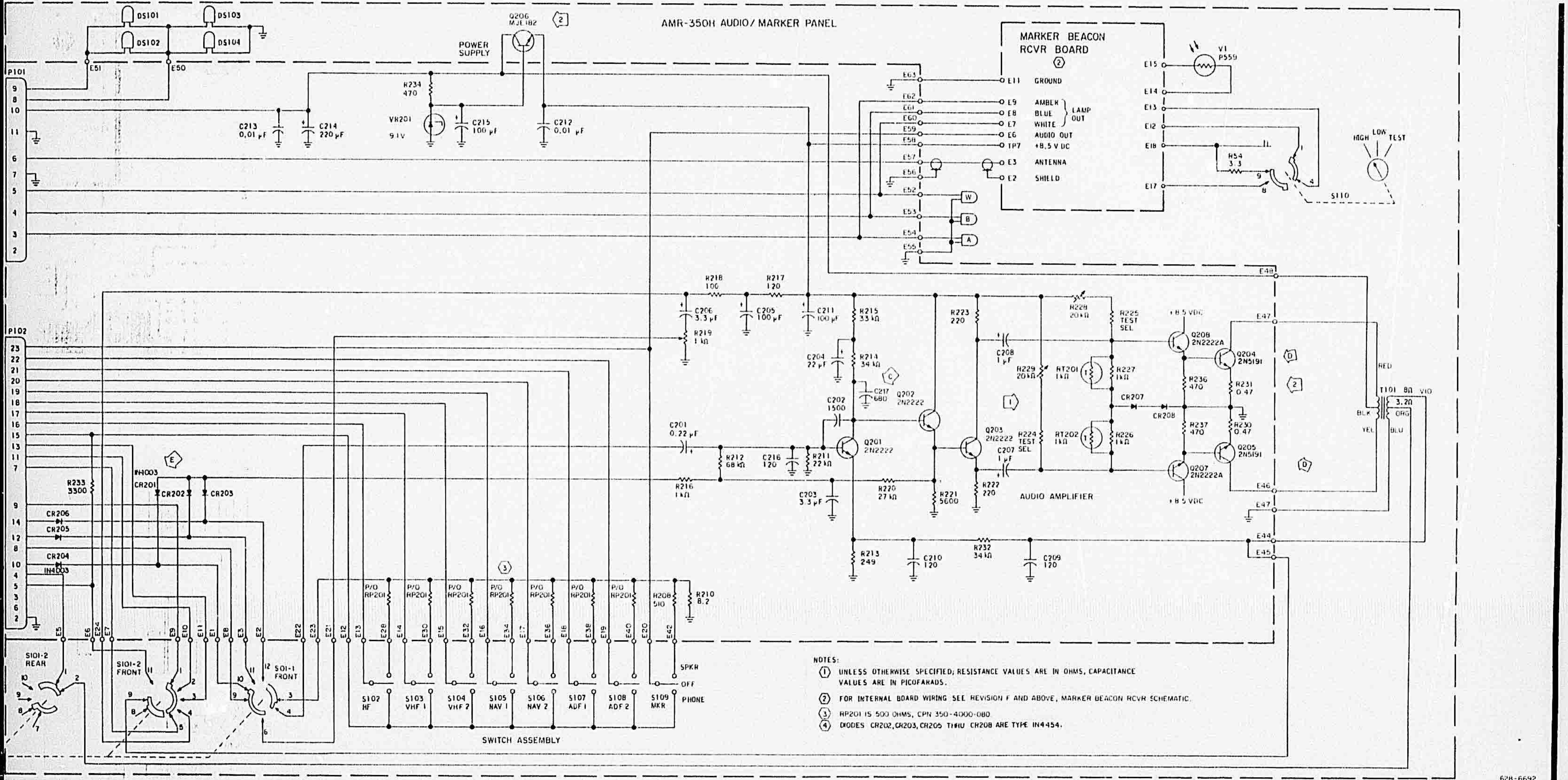
628-7475

REVISIONS A THROUGH D



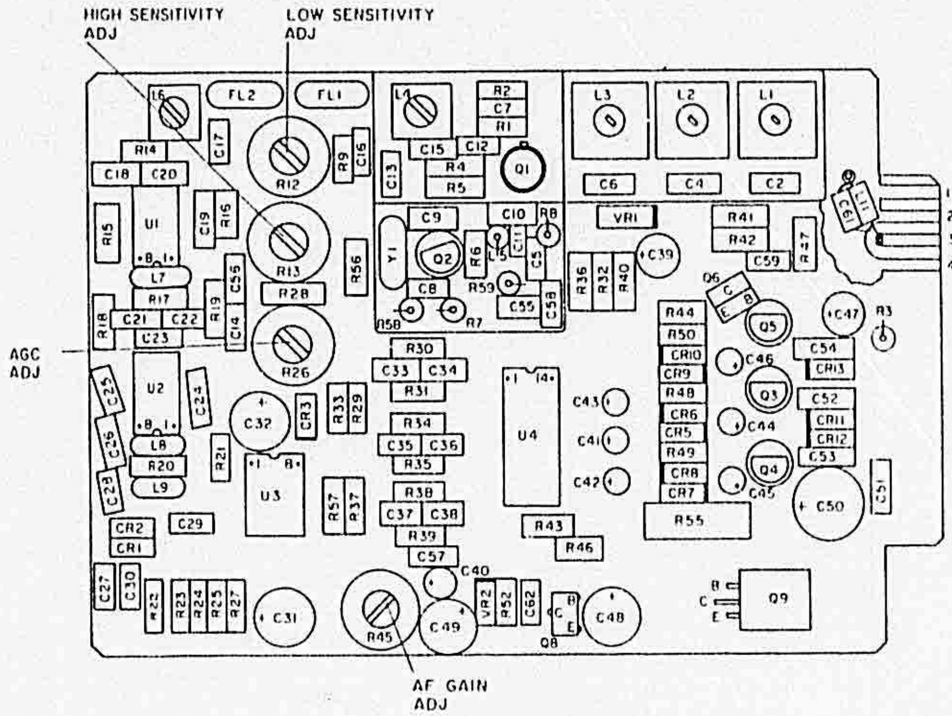
SEE BLOW-UP FICHE NO. CRL103 - ITEM W

6-45



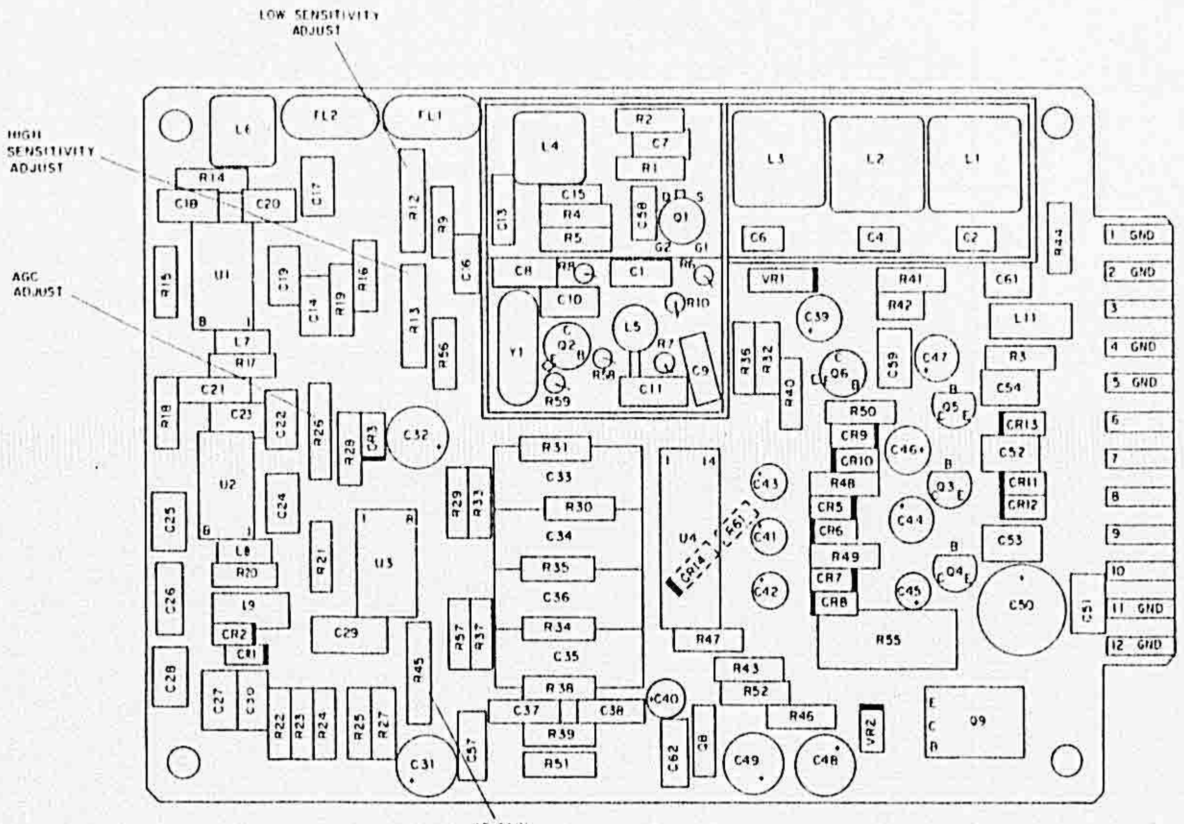
AMR-350H Audio/Marker Panel, Effective Audio Board Number 628-6114-XXX, Schematic Diagram
Figure 6-28

SEE BLOW–UP FICHE NO. CRL103 - ITEM W



REVISION A THROUGH E

628-5835

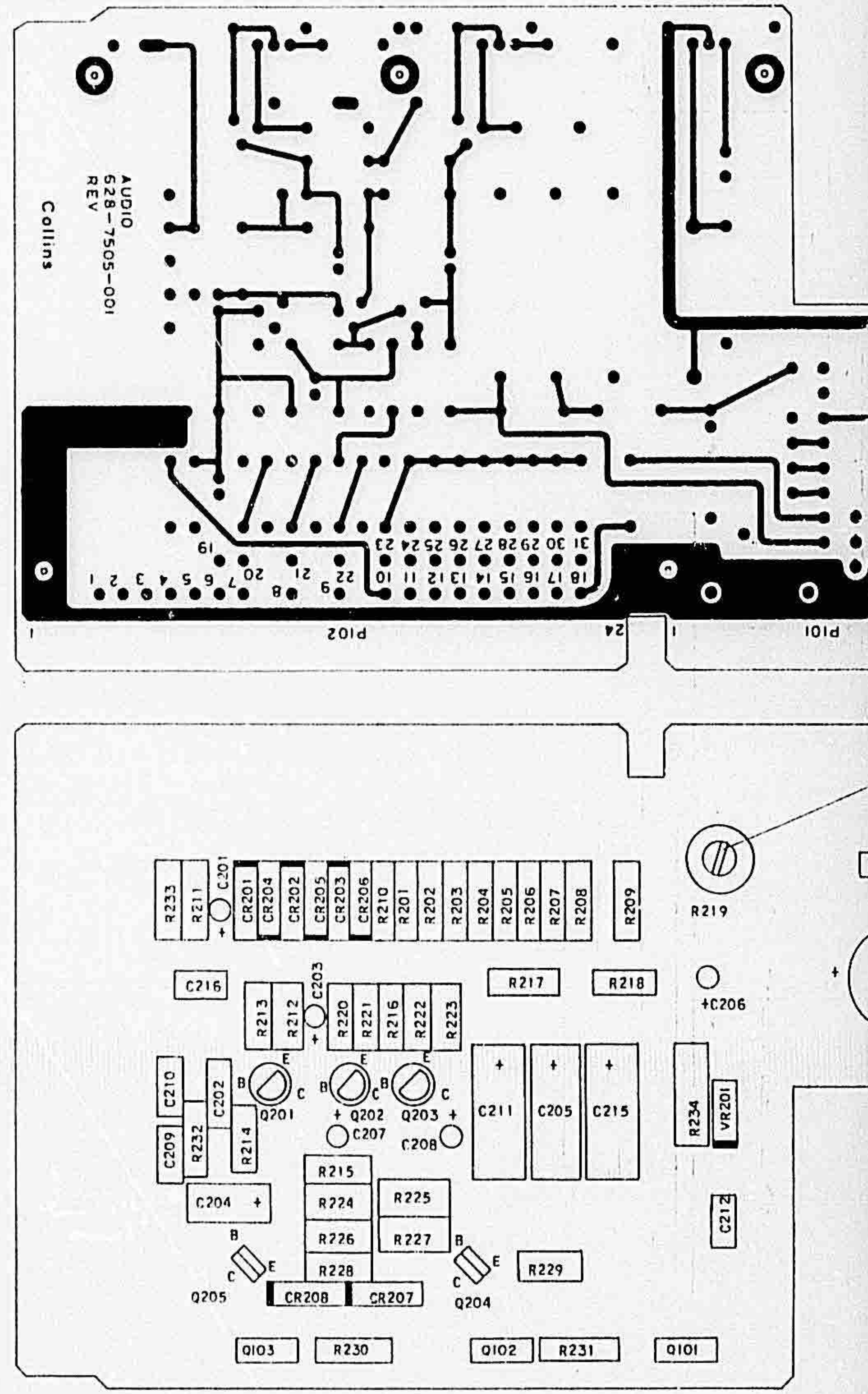


EFF REVISION F

628-6635

AMR-350H Marker Board, Component Location Diagram
Figure 6-29

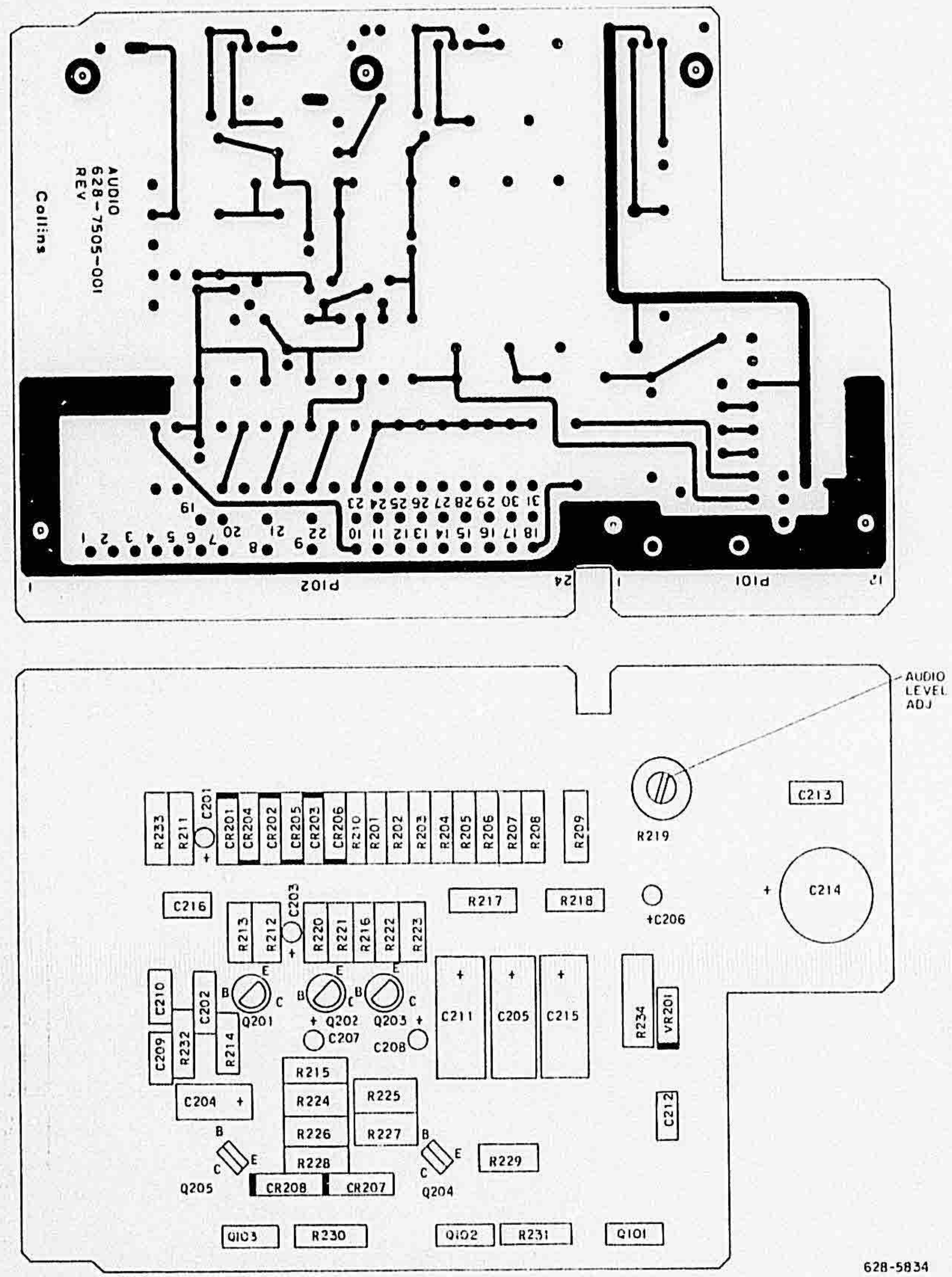
628-6635



NOTE: DIODES CR201 AND CR204 ARE USED IN AMR-350H AND AUD-250H UNITS ONLY.

AMR-350H Audio Board, Effective Board Number
628-7505-XXX, Component Location Diagram
Figure 6-30

6-96



628-5834
1P4-3110-014

NOTE: DIODES CR201 AND CR204 ARE USED IN AMR-350H AND AUD-250H UNITS ONLY.

AMR-350H Audio Board, Effective Board Number 628-7505-XXX, Component Location Diagram
Figure 6-30

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Rearranged graphic configuration of switches S101 and S110 to show actual switching sequence.	NA	NA
2	Added dual ADF switching functions.	NA	All models
3	Resistors R212 and R220 were 47 kΩ, R216 was 2700 Ω. Values changed to ensure muting with diode in aircraft key line.	NA	REV C
4	Changed R214 and R232 from 33 to 34.0 kΩ and R213 from 270 to 267 Ω to stabilize audio amplifier gain.	NA	REV D

AMR-350H Audio/Marker Panel, Effective Audio Board Number 628-7505-XXX, Schematic Diagram
Figure 6-31 (Sheet A)

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C1	NOT USED	
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C3	NOT USED	
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.5PF, ±0.25PF, 50V	913-3308-010
C5	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C8	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 33PF, ±5%, 50V	913-3308-160
C10	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 47PF, ±5%, 50V	913-3308-180
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22PF, ±5%, 50V	913-3308-140
C12	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22,000PF, +80-20%, 50V	913-3311-020
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22,000PF, +80-20%, 50V	913-3311-020
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C29	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 1000PF, ±10%, 50V	933-1409-010
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C31	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C32	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 10V	183-1471-130
C33	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 33,000PF, ±5%, 50V	933-1409-060
C34	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 33,000PF, ±5%, 50V	933-1409-060
C35	CAPACITOR, FIXED, PLASTIC DIELECTRIC, .01UF, ±5%, 50V	933-1409-050
C36	CAPACITOR, FIXED, PLASTIC DIELECTRIC, .01UF, ±5%, 50V	933-1409-050
C37	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 3300PF, ±5%, 50V	933-1409-040
C38	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 3300PF, ±5%, 50V	933-1409-040
C39	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C40	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C41	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C42	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C43	CAPACITOR, FIXED, TANTALUM, .47UF, ±20%, 35V	184-9113-020
C44	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-0113-200
C45	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C46	CAPACITOR, FIXED, TANTALUM, 2.2UF, ±20%, 15V	184-9113-200
C47	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 16V	183-1471-140
C48	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 16V	183-1471-100
C49	NOT USED	
C50	NOT USED	
C51	NOT USED	
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +89-20%, 50V	913-3311-010
C53	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C54	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
C55	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C56	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C60	NOT USED	
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C63-C200	NOT USED	
C201	CAPACITOR, FIXED, TANTALUM, .22UF, ±20%, 35V	184-9113-210
C202	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 1500PF, ±10%, 50V	933-1409-020
C203	CAPACITOR, FIXED, TANTALUM, 3.3UF, ±20%, 10V	184-9113-170
C204	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, +100-20%, 16V	183-1471-180
C205	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, +100-20%, 16V	183-1471-120
C206	CAPACITOR, FIXED, TANTALUM, 3.3UF, ±20%, 10V	184-9113-170
C207	CAPACITOR, FIXED, TANTALUM, 1.0UF, ±20%, 20V	184-9113-030
C208	CAPACITOR, FIXED, TANTALUM, 1.0UF, ±20%, 20V	184-9113-030
C209	CAPACITOR, FIXED, CERAMIC, DIELECTRIC, 120PF, ±5%, 50V	913-3308-210
C210	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 120PF, ±5%, 50V	913-3308-210
C211	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, +100-20%, 16V	183-1471-120
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C213	CAPACITOR, FIXED, CERAMIC DIELECTRIC, .01UF, +80-20%, 50V	913-3311-010
C214	CAPACITOR, FIXED, ELECTROLYTIC, 220UF, +100-20%, 50V	183-1471-170
C215	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, +100-20%, 16V	183-1471-120
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 120PF, ±5%, 50V	913-3308-210
CR1	DIODE, 1S1588	353-0450-010
CR2	DIODE, 1S1588	353-0450-010
CR3	DIODE, 1S1588	353-0450-010
CR4	NOT USED	
CR5	DIODE, 1S1588	353-0450-010

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
CR6	DIODE, 1S1588	353-0450-010
CR7	DIODE, 1S1588	353-0450-010
CR8	DIODE, 1S1588	353-0450-010
CR9	DIODE, 1S1588	353-0450-010
CR10	DIODE, 1S1588	353-0450-010
CR11	DIODE, 1S1588	353-0450-010
CR12	DIODE, 1S1588	353-0450-010
CR13	DIODE, 1S1588	353-0450-010
CR14- CR200	NOT USED	
CR201	DIODE, 1S1588	353-0450-010
CR202	DIODE, 1S1588	353-0450-010
CR203	DIODE, 1S1588	353-0450-010
CR204	DIODE, 1S1588	353-0450-010
CR205	DIODE, 1S1588	353-0450-010
CR206	DIODE, 1S1588	353-0450-010
CR207	DIODE, 1S1588	353-0450-010
CR208	DIODE, 1S1588	353-0450-010
DS1	LAMP	262-1398-070
DS2	LAMP	262-1398-070
DS3	LAMP	262-1398-070
DS4- DS100	NOT USED	
DS101	LAMP	262-1398-080
DS102	LAMP	262-1398-080
DS103	LAMP	262-1398-080
DS104	LAMP	262-1398-080
FL1	FILTER, BANDPASS, CRYSTAL, 10.7MHZ	293-1305-010
FL2	FILTER, BANDPASS, CRYSTAL, 10.7MHZ	293-1305-010
L1	COIL, 75MHZ	278-0420-010
L2	COIL, 75MHZ	278-0420-010
L3	COIL, 75MHZ	278-0420-010
L4	COIL, 85AC-3000A, 10.7MHZ	278-0419-010
L5	COIL, 0.22UH	240-2742-210
L6	COIL, 85AC-3000A, 10.7MHZ	278-0419-010
L7	COIL, 3.3UH	240-2742-160
L8	COIL, 3.3UH	240-2742-160
L9	COIL, 100UH	240-2742-170
L10	NOT USED	
L11	COIL, 0.68UH	240-2742-020
Q1	TRANSISTOR, 3SK35Y	352-5042-010
Q2	TRANSISTOR, 2SC 385A	352-5047-010
Q3	TRANSISTOR, 2SC982	352-5043-010
Q4	TRANSISTOR, 2SC982	352-5043-010
Q5	TRANSISTOR, 2SC982	352-5043-010
Q6	TRANSISTOR, 2SC509Y	352-5046-010
Q7	NOT USED	
Q8	TRANSISTOR, MJE-800	352-5028-010

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
Q9-Q100	NOT USED	
Q101	TRANSISTOR, 2SD234-Y	352-5041-010
Q102-Q200	NOT USED	
Q201	TRANSISTOR, 2SC372-Y	352-5044-010
Q202	TRANSISTOR, 2SC372-Y	352-5044-010
Q203	TRANSISTOR, 2SC372-Y	352-5044-010
Q204	TRANSISTOR, 2SC1166Y	352-5048-010
Q205	TRANSISTOR, 2SC1166Y	352-5048-010
R1	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R2	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 5%, 1/4W	745-7958-030
R3	NOT USED	
R4	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R5	RESISTOR, FIXED, COMPOSITION, 180 OHMS, 5%, 1/4W	745-7958-060
R6	RESISTOR, FIXED, COMPOSITION, 150 OHMS, 5%, 1/4W	745-7958-050
R7	RESISTOR, FIXED, COMPOSITION, 8200 OHMS, 5%, 1/4W	745-7958-280
R8	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R9	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R10	NOT USED	
R11	NOT USED	
R12	RESISTOR, VARIABLE, 2000 OHMS, ±20%, 0.5W	382-0500-020
R13	RESISTOR, VARIABLE, 2000 OHMS, ±20%, 0.5W	382-0500-020
R14	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R15	RESISTOR, FIXED, COMPOSITION, 1000 OHMS, 5%, 1/4W	745-7958-170
R16	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R17	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R18	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R19	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R20	RESISTOR, FIXED, COMPOSITION, 820 OHMS, 5%, 1/4W	745-7958-160
R21	RESISTOR, FIXED, COMPOSITION, 3900 OHMS, 5%, 1/4W	745-7958-240
R22	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R23	RESISTOR, FIXED, COMPOSITION, 27,000 OHMS, 5%, 1/4W	745-7958-340
R24	RESISTOR, FIXED, COMPOSITION, 56,000 OHMS, 5%, 1/4W	745-7958-390
R25	RESISTOR, FIXED, COMPOSITION, 1000 OHMS, 5%, 1/4W	745-7958-170
R26	RESISTOR, VARIABLE, 10,000 OHMS, ±20%, 1/4W	382-0500-030
R27	RESISTOR, FIXED, COMPOSITION, 3300 OHMS, 5%, 1/4W	745-7958-230
R28	RESISTOR, FIXED, COMPOSITION, 4700 OHMS, 5%, 1/4W	745-7958-250
R29	RESISTOR, FIXED, FILM, 12,100 OHMS, ±1%, 1/8W	745-7957-310
R30	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190
R31	RESISTOR, FIXED, FILM, 1820 OHMS, ±1%, 1/8W	745-7956-510
R32	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R33	RESISTOR, FIXED, FILM, 10,000 OHMS, ±1%, 1/8W	745-7957-230
R34	RESISTOR, FIXED, FILM, 97,600 OHMS, ±1%, 1/8W	745-7403-190

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
R35	RESISTOR, FIXED, FILM, 1620 OHMS, ±1%, 1/8W	745-7956-460
R36	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R37	RESISTOR, FIXED, FILM, 15,000 OHMS, ±1%, 1/8W	745-7957-400
R38	RESISTOR, FIXED, FILM, 130,000 OHMS, ±1%, 1/8W	745-7403-310
R39	RESISTOR, FIXED, FILM, 2100 OHMS, ±1%, 1/8W	745-7956-570
R40	RESISTOR, FIXED, COMPOSITION, 100K, 5%, 1/4W	745-7958-420
R41	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R42	RESISTOR, FIXED, COMPOSITION, 1M, 5%, 1/4W	745-7958-520
R43	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R44	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R45	RESISTOR, VARIABLE, 10,000 OHMS, ±20%, 0.5W	382-0500-030
R46	RESISTOR, FIXED, COMPOSITION, 0.47 OHMS, 5%, 1/4W	745-7958-500
R47	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R48	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R49	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R50	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R51	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R52	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS, 5%, 1/4W	745-7958-290
R53	NOT USED	
R54	RESISTOR, FIXED, COMPOSITION, 3.3 OHMS, 10%, 1/2W	745-7951-260
R55	NOT USED	
R56	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R57	RESISTOR, FIXED, COMPOSITION, 1200 OHMS, 5%, 1/4W	745-7958-180
R58	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R59	RESISTOR, FIXED, COMPOSITION, 680 OHMS, 5%, 1/4W	745-7958-150
R60-R200	NOT USED	
R201	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R202	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R203	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R204	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R205	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R206	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R207	RESISTOR, FIXED, COMPOSITION, 510 OHMS, 5%, 1/4W	745-7958-130
R208	RESISTOR, FIXED, COMPOSITION, 390 OHMS, 5%, 1/4W	745-7958-100
R209	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R210	RESISTOR, FIXED, COMPOSITION, 8200 OHMS, 5%, 1/4W	745-7958-280
R211	RESISTOR, FIXED, COMPOSITION, 22,000 OHMS, 5%, 1/4W	745-7958-330
R212	RESISTOR, FIXED, COMPOSITION, 68K, 10%, 1/4W (EFF REV C)	745-7950-470
R212	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R213	RESISTOR, FIXED, FILM, 267 OHMS, ±1%, 1/8W (EFF REV D)	745-7955-700

PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

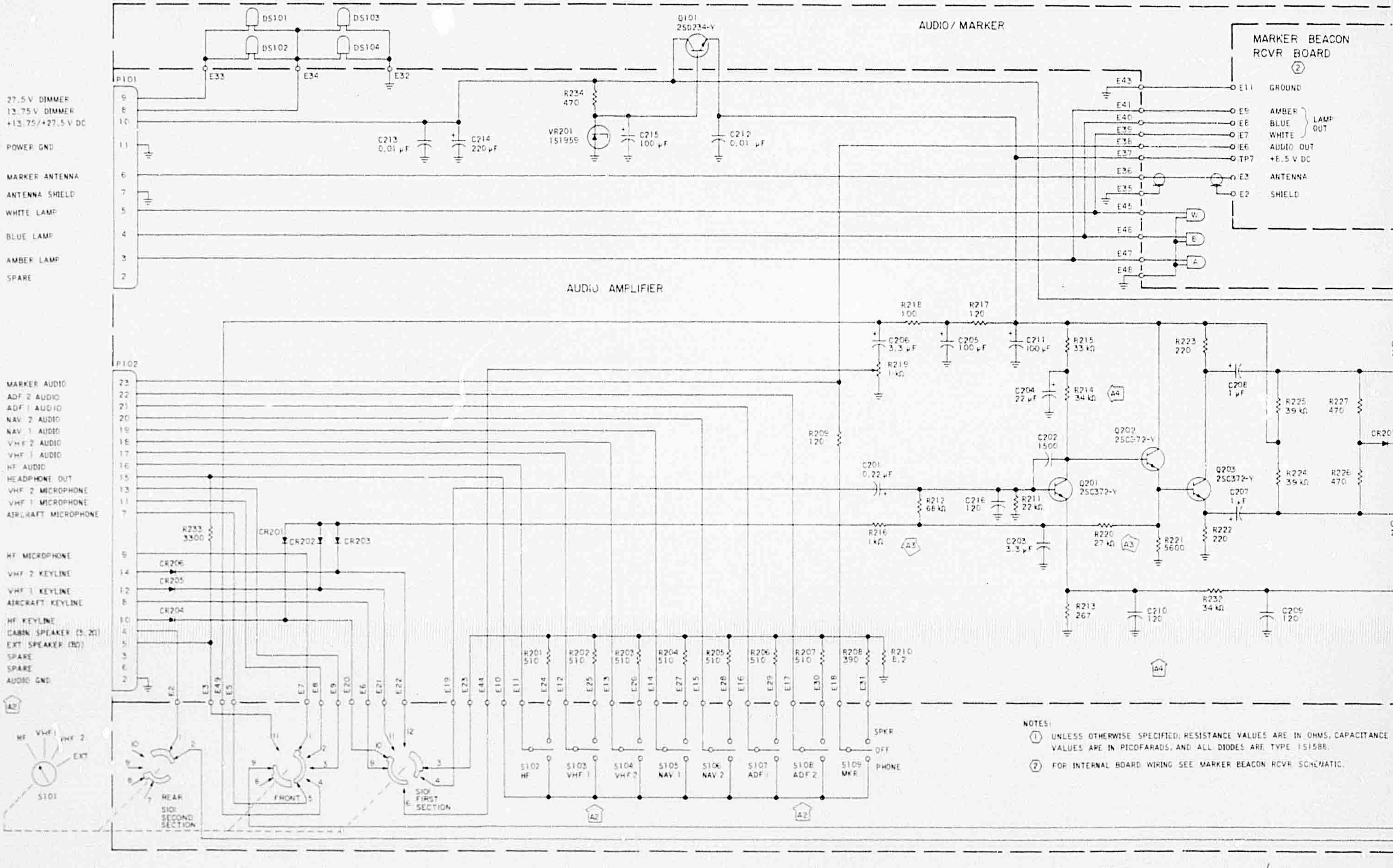
SYMBOL	DESCRIPTION	PART NUMBER
R213	RESISTOR, FIXED, COMPOSITION, 270 OHMS, 5%, 1/4W	745-7958-080
R214	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R214	RESISTOR, FIXED, COMPOSITION, 33,000 OHMS, 5%, 1/4W	745-7958-350
R215	RESISTOR, FIXED, COMPOSITION, 33,000 OHMS, 5%, 1/4W	745-7958-350
R216	RESISTOR, FIXED, COMPOSITION, 1K, 10%, 1/4W (EFF REV C)	745-7950-250
R216	RESISTOR, FIXED, COMPOSITION, 2700 OHMS, 5%, 1/4W	745-7958-220
R217	RESISTOR, FIXED, COMPOSITION, 120 OHMS, 5%, 1/4W	745-7958-040
R218	RESISTOR, FIXED, COMPOSITION, 100 OHMS, 5%, 1/4W	745-7958-030
R219	RESISTOR, VARIABLE, 1K, 1/2W	382-0045-010
R220	RESISTOR, FIXED, COMPOSITION, 27K, 10%, 1/4W (EFF REV C)	745-7950-420
R220	RESISTOR, FIXED, COMPOSITION, 47,000 OHMS, 5%, 1/4W	745-7958-370
R221	RESISTOR, FIXED, COMPOSITION, 5600 OHMS, 5%, 1/4W	745-7958-260
R222	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R223	RESISTOR, FIXED, COMPOSITION, 220 OHMS, 5%, 1/4W	745-7958-070
R224	RESISTOR, FIXED, COMPOSITION, 39,000 OHMS, 5%, 1/4W	745-7958-360
R225	RESISTOR, FIXED, COMPOSITION, 39,000 OHMS, 5%, 1/4W	745-7958-360
R226	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R227	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R228	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R229	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 5%, 1/4W	745-7958-120
R230	RESISTOR, FIXED, WIREWOUND, 0.47 OHM, ±100%, 2W	745-0909-020
R231	RESISTOR, FIXED, WIREWOUND, 0.47 OHM, ±100%, 2W	745-0909-020
R232	RESISTOR, FIXED, FILM, 34.0K, ±1%, 1/8W (EFF REV D)	745-7957-740
R232	RESISTOR, FIXED, COMPOSITION, 33K, 5%, 1/4W	745-7958-350
R233	RESISTOR, FIXED, COMPOSITION, 3300 OHMS, 5%, 1/4W	745-7958-230
R234	RESISTOR, FIXED, COMPOSITION, 470 OHMS, 10%, 1W	745-7952-210
S1-S100	NOT USED	
S101	SWITCH, WAFER	259-1024-030
S102	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S103	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090

*PART NUMBERS ARE SWITCH/LEVER CAP.

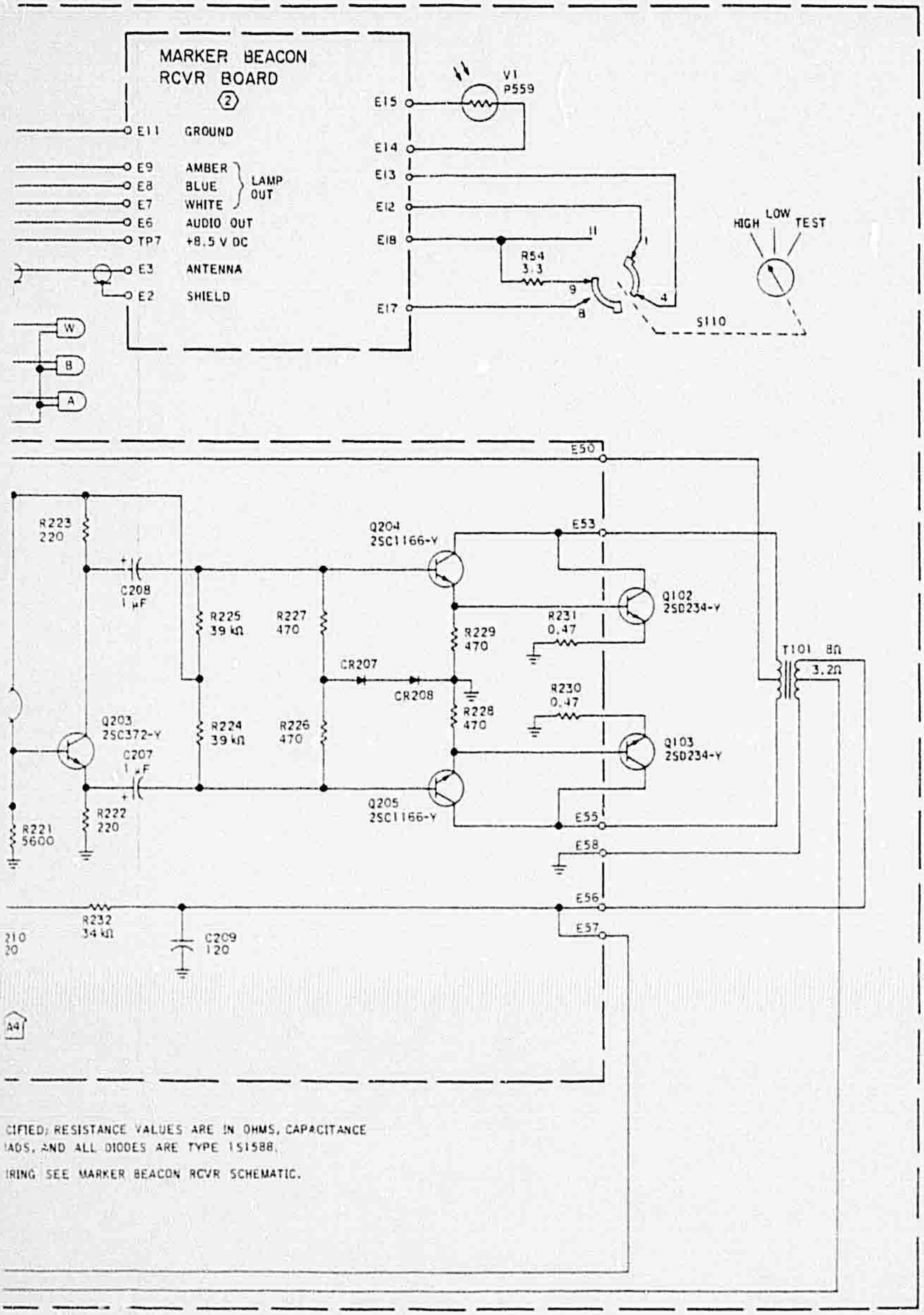
PARTS LIST
AMR-350H AUDIO/MARKER PANEL
ASSEMBLIES 628-7606-002 AND 628-7605-002

SYMBOL	DESCRIPTION	PART NUMBER
S104	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S105	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S106	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001/ 266-5417-090
S107	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001 266-5417-090
S108	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001 266-5417-090
S109	SWITCH, TOGGLE/CAP	*266-5417-130/ 266-5417-140 OR *628-7373-001 266-5417-090
S110	SWITCH, WAFER	259-1024-010
U1	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U2	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U3	INTEGRATED CIRCUIT, MC1458CP1	351-1156-020
U4	INTEGRATED CIRCUIT, MC3401P	351-1611-010
VR1	ZENER DIODE, RD5A-N	353-3740-210
VR2- VR200	NOT USED	
VR201	ZENER DIODE, 1S1959, 9.1V	353-3737-130
Y1	CRYSTAL UNIT, QUARTZ, 85.7MHZ	289-7260-020

*PART NUMBERS ARE SWITCH/LEVER CAP.



SEE BLOW-UP FICHE NO. CRL104 - ITEM A



628-5605
TP4-0526-025

AMR-350H Audio/Marker Panel, Effective Audio Board Number 628-7505-XXX, Schematic Diagram
Figure 6-31

SEE BLOW-UP FICHE NO. CRL104 - ITEM A

Collins MKR-350 Marker Receiver
MKL-350/351 Remote Marker Lights
AUD-250/250H/251H Audio Panel
AMR-350/350H Audio/Marker Panel

Rockwell International

bulletins

Collins General Aviation Division

Printed in USA

523-0766042-004118
4th Edition, 9 June 1982

Bulletins

MKR-350, MKL-350/351, AUD-250/250H/251H, AMR-350/350H

523-0766042-004118

Service Bulletins and Service Information Letters Issued to Date

SB/SIL Number	Unit	Title	Date
1	AMR-350	Thermal Drift in 28-Volt Installations	Jun 1/77
2R1	AMR-350	Improved Oscillator Performance	Jan 16/81
3	AMR-350	Increased Sidetone Output Level for Interphone Application	Nov 21/77
4	AMR-350	Additional Audio Input	Jul 21/78
5R1	AMR-350	Marker Receiver-to-Transponder Interference	Jan 16/81
6	AMR-350	Use of Middle Marker Output to Trigger Autopilot Gain Programmer	May 1/80
1	AMR-350H	Additional Audio Input	Feb 23/76
2	AMR-350H	Thermal Drift in 28-Volt Installations	Jun 1/77
3	AMR-350H	Improved Oscillator Performance	Nov 15/77
4	AMR-350H	Increased Sidetone Output Level for Interphone Application	Nov 21/77
5	AMR-350H	HF Keyline Transient Suppression	Jan 12/79
6	AMR-350H	Marker Receiver-to-Transponder Interference	Apr 18/79
7	AMR-350H	Use of Middle Marker Output to Trigger Autopilot Gain Programmer	May 1/80
8	AMR-350H	Switch VHF-253/253S Transfer/Select Control Automatically	May 11/82
1	AUD-250	Thermal Drift in 28-Volt Installations	Jun 1/77
2	AUD-250	Increase Sidetone Output Level for Interphone Applications	Nov 21/77
3	AUD-250	Additional Audio Input	Feb 23/78
1	AUD-250H	Thermal Drift in 28-Volt Installations	Jun 1/77
2	AUD-250H	Increase Sidetone Output Level for Interphone Applications	Nov 21/77
3R1	AUD-250H	Additional Audio Input	Oct 10/80
4	AUD-250H	HF Keyline Transient Suppression	Jan 12/79
1	AUD-251H	Thermal Drift in 28-Volt Installations	Jun 1/77
2	AUD-251H	HF Keyline Transient Protection	Jan 12/79
3R1	AUD-251H	Increase Headphone Drive	Aug 3/81
4	AUD-251H	Improve Operation With Low Resistance Microphones	Jun 6/80
1	MKR-350	Improved Oscillator Performance	Nov 15/77
2	MKR-350	Capacitor C51 Replacement	Feb 17/78
3	MKR-350	Marker Receiver-to-Transponder Interference	Apr 18/79
4	MKR-350	Use of Middle Marker Output to Trigger Autopilot Gain Programmer	May 1/80
1-75	AMR-350	Toggle Switch Replacement/Interchangeability	Sep 1/75
2-75	AMR-350	Alteration of Speaker Muting Circuit	Nov 1/75
1-76	AMR-350	Replacement of Rotary Switch Control Knobs	Sep 1/76
1-77	AMR-350	Receiver Sensitivity Adjustment	Jan 10/77
2-77	AMR-350	Marker Receiver 87.5 MHz Oscillator Tuning Procedure	Sep 1/77
3-77	AMR-350	28-Volt Installation Dropping Resistor	Oct 5/77

(Cont)

NOTICE: This title page replaces third edition title page dated 1 June 1978.

SB/SIL Number	Unit	Title	Date
4-77	AMR-350	Audio/Marker Panel Operating Characteristics	Oct 14/77
1-79	AMR-350	Marker Audio Interference	Jan 19/79
2-79	AMR-350	Dropping Resistor Cover Modification	Mar 15/79
3-79	AMR-350	Position of Marker Board Capacitors C41, C42 and C43	Oct 19/79
1-75	AMR-350H	Toggle Switch Replacement/Interchangeability	Sep 1/75
2-75	AMR-350H	Alteration of Speaker Muting Circuit	Nov 1/75
1-76	AMR-350H	Replacement of Rotary Switch Control Knobs	Sep 1/76
1-77	AMR-350H	Receiver Sensitivity Adjustment	Jan 10/77
2-77	AMR-350H	Marker Receiver 87.5 MHz Oscillator Tuning Procedure	Sep 1/77
3-77	AMR-350H	28-Volt Installation Dropping Resistor	Oct 5/77
4-77	AMR-350H	Audio/Marker Panel Operating Characteristics	Oct 14/77
1-79	AMR-350H	Marker Audio Interference	Jan 19/79
2-79	AMR-350H	Dropping Resistor Cover Modification	Mar 15/79
3-79	AMR-350H	Position of Marker Board Capacitors C41, C42 and C43	Oct 19/79
1-75	AUD-250	Toggle Switch Replacement/Interchangeability	Sep 1/75
2-75	AUD-250	Alteration of Speaker Muting Circuit	Nov 1/75
1-76	AUD-250	Replacement of Rotary Switch Control Knobs	Sep 1/76
1-77	AUD-250	28-Volt Installation Dropping Resistor	Oct 5/77
2-77	AUD-250	Audio Panel Operating Characteristics	Oct 14/77
1-79	AUD-250	Dropping Resistor Cover Modification	Mar 15/79
1-75	AUD-250H	Toggle Switch Replacement Interchangeability	Sep 1/75
2-75	AUD-250H	Alteration of Speaker Muting Circuit	Nov 1/75
1-76	AUD-250H	Replacement of Rotary Switch Control Knobs	Sep 1/76
1-77	AUD-250H	28-Volt Installation Dropping Resistor	Oct 5/77
2-77	AUD-250H	Audio Panel Operating Characteristics	Oct 14/77
1-79	AUD-250H	Dropping Resistor Cover Modification	Mar 15/79
1-76	AUD-251H	Replacement of Rotary Switch Control Knobs	Sep 1/76
1-78	AUD-251H	Isolating Headphones From Each Other	Jul 17/78
1-77	MKR-350	Receiver Sensitivity Adjustment	Jun 10/77
2-77	MKR-350	Marker Receiver 87.5 MHz Oscillator Tuning Procedure	Sep 1/77
1-79	MKR-350	Position of Marker Board Capacitors C41, C42 and C43	Oct 19/79

02

Rockwell International

Collins GLS-350/350E Glideslope Receiver

description

Collins General Aviation Division

Printed in USA

523-0766022-004118
4th Edition, 9 June 1982

table of contents

NOTICE: This section replaces third edition dated 15 June 1976.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change

Page No	Issue
*Title	9 Jun 82
*List of Effective Pages	9 Jun 82
*1-1	9 Jun 82
1-2	15 Jun 76
*1-3	9 Jun 82
*1-4 Blank	9 Jun 82

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None				
2nd Ed	1 Sep 75		None				
3rd Ed	15 Jun 76		None				
4th Ed	9 Jun 82		GLS-350: SB 1,2, SIL 1-76 GLS-350E: SB 1, SIL 1-76				

section I description

1.1 INTRODUCTION

This instruction book contains all the specifications, installation instructions, equipment operating procedures, principles of operation, and information necessary for proper maintenance and repair of the GLS-350/350E Glideslope Receiver.

1.2 PURPOSE OF EQUIPMENT

The GLS-350/350E Glideslope Receiver is a 40-channel unit designed to operate with the VIR-351 Navigation Receiver and an external ARINC type indicator such as the IND-351 or IND-351C Indicator. When an ILS frequency is selected, the VIR-351 automatically channels the GLS-350/350E to the appropriate glideslope frequency. The GLS-350/350E in turn supplies glideslope deviation information to the indicator.

The GLS-350E differs from the GLS-350 in that it is designed for use in European-registered aircraft. Operation is identical to that of the GLS-350; however, the GLS-350E meets the more stringent specifications on spurious emissions required for European approval.

Part numbers for the GLS-350/350E are listed below.

EQUIPMENT TYPE NUMBER	COLLINS PART NUMBER
GLS-350	622-2084-001
GLS-350E	622-3366-001

1.3 DESIGN FEATURES

- 40-channel operation.
- Capable of driving external deviation and alarm flag circuits such as autopilots with no requirements for dummy loads.
- Dual-gate MOSFET mixers and first if amplifier to provide maximum sensitivity and freedom from spurious response.
- Digital frequency synthesizer.
- Crystal filter selectivity to ensure maximum rejection of adjacent channel interference.
- Complete solid-state circuitry with no relays.
- High maintainability with quick access to all circuitry.

1.4 EQUIPMENT SPECIFICATIONS

Table 1-1 lists the equipment specifications of the GLS-350/350E Glideslope Receiver.

1.5 EQUIPMENT SUPPLIED

Supplied with the GLS-350/350E Glideslope Receiver is an installation kit (CPN 628-7630-001) that contains the following materials:

DESCRIPTION	QTY	COLLINS PART NUMBER
*Connector receptacle, 25 pin	1	371-0379-090
Socket contacts	16	371-0379-130
Rf connector	1	357-0038-010
Slide-lock retainer	1	371-0379-160
Hood, straight	1	371-0379-170
Tray assembly	1	628-7558-001

*An optional solder pot type connector may be substituted, Collins part number 371-0381-020 (Cannon part number DB-25S).

1.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The following equipment is required for proper operation of the GLS-350/350E, but is not supplied with the unit:

a. Glideslope antenna (such as 37P-2/3/4/5)
b. VIR-350 or VIR-351 Navigation Receiver

Table 1-1. GLS-350/350E Glideslope Receiver Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS	
Related documents		
FAA TSO	-C34c, class D; category CANBAAEXXXXX DO 138.	
Physical		
Dimensions		
GLS-350	UNIT ONLY	UNIT AND TRAY
Width	25.40 mm (1.00 in).	32.40 mm (1.276 in).
Height	127.00 mm (5.00 in).	135.2 mm (5.32 in).
Length	273.90 mm (10.78 in).	280.7 mm (11.05 in).
GLS-350E	UNIT ONLY	UNIT AND TRAY
Width	25.40 mm (1.00 in).	32.40 mm (1.276 in).
Height	127.00 mm (5.00 in).	135.2 mm (5.32 in).
Length	345.44 mm (13.60 in).	345.44 mm (13.60 in).
Mounting		
Mounting tray	Collins part number 628-7558-001.	
Weight		
GLS-350	0.91 kg (2.0 lb).	
GLS-350E	1.02 kg (2.25 lb).	
Environmental		
Temperature range		
Continuous	-40 to +71 °C (-40 to +159.8 °F).	
Storage	To +85 °C (+185 °F).	
Altitude	9,144 m (30,000 ft) operational.	
Cooling	Convection.	
Relative humidity	95% at +50 °C (+122 °F).	
Shock		
Operational	6 g.	
Crash safety	15 g (10 ms duration).	
Electrical		
Power requirements	13.75 V dc, 7 W.	
Frequency range	329.15 through 335.00 MHz in 150-kHz increments.	
Frequency stability	±0.005%.	
Sensitivity	20 μV for 60% of standard deflection.	
If selectivity	6 dB ±40 kHz min, 60 dB ±100 kHz maximum.	
Deflection sensitivity	78 mV at 0.091 DDM (2 dB nominal).	
Centering accuracy	Not more than ±7 mV.	
Deviation loads	One to eight 1,000-ohm (150-0-150 μA) meter movements in parallel (dummy loads not required).	
Flag loads	One to nine 1,000-ohm meter movements in parallel (dummy loads not required).	

c. ARINC indicator (such as IND-351/351C)
d. Interconnecting cables
e. PWC-150 Power Converter (for +28-V systems)

Publications related to the GLS-350/350E are listed in table 1-2.

Table 1-2. Related Publications.

TITLE	COLLINS PART NUMBER
Collins General Aviation Antennas Instruction Book (includes 37P-2/3/4/5 Glideslope Antenna)	523-0769091
VIR-350 Navigation Receiver Instruction Book	523-0766704
VIR-351 Navigation Receiver, IND-350( )/351( ) Indicator and PWC-150 Power Converter Instruction Book	523-0766030
IND-30/31/31C Indicator Instruction Book	523-0769614

Collins GLS-350/350E Glideslope Receiver

Rockwell International

installation

Collins General Aviation Division
523-0766023-004118
4th Edition, 9 June 1982

Printed in USA

table of contents

NOTICE: This section replaces third edition dated 15 June 1976.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		Nohe				
2nd Ed	1 Sep 75		None				
3rd Ed	15 Jun 76		None				
4th Ed	9 Jun 82		GLS-350: SB 1, 2, SIL 1-76 GLS-350E: SB 1, SIL 1-76				

2.1 GENERAL

The installation data contained in this section consists of unpacking and inspection checks, special instructions, installation procedures, and postinstallation testing.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Unpack the equipment carefully and make a careful visual inspection of each unit for possible shipping damage. All claims for damage should be filed with the transportation company involved. If claims for damage are to be filed, save the original packing carton and materials. If no defects can be detected, replace packing materials in the shipping container and save for future uses such as storage or reshipment.

2.3 SPECIAL INSTRUCTIONS

There are no special instructions to be followed when installing the GLS-350/350E Glideslope Receiver. Refer to paragraph 2.4 for installation procedures.

2.4 INSTALLATION PROCEDURES

The following installation procedures must be performed as described to ensure proper operation and performance. Any deviation from these instructions may result in reduced performance and/or damage to the equipment.

Caution

Remove power before installing or removing the GLS-350/350E.

a. The installation kit (CPN 628-7630-001) supplied with the GLS-350/350E is required for installation. Refer to figure 2-1.
b. The GLS-350/350E is rigidly mounted to the airframe. Select a location that allows at least 25.4 mm (1 in) air space around the top and rear of the unit, and 12.7 mm (1/2 in) on each side.
c. Refer to the GLS-350 and GLS-350E outline and mounting dimensions drawings, figures 2-2 and 2-3, to determine placement of mounting holes.
d. Secure the mounting tray in place using three #8 screws.
e. Slide the GLS-350/350E into its mounting tray and engage the screw-actuated latch.

2.5 CABLING

Figure 2-6 is the interconnect wiring diagram for the GLS-350/350E. Mating connector part numbers are shown on the outline and mounting diagram. Figure 2-4 illustrates the mating connector pin assignments.

During preparation of the interconnect wiring cables, observe the following precautions:

a. Bond and shield all parts of the aircraft electrical system, such as generator and ignition systems.
b. Keep the interconnect cables away from circuits carrying heavy current, pulse transmitting equipment, and other sources of interference.
c. Leave slack in cables to allow for movement due to vibration.
d. After installation of the cables in the aircraft and before installation of the equipment, a check should be made to ensure the aircraft power is applied only to the pins specified.
e. Remove and install connector contacts in accordance with steps f through h. Table 2-1 lists the special tools required to perform the following steps.
f. During installation of the mating connector, the connecting wire must be crimped in the contact so that the crimped portion of the contact can enter the connector shell and provide a positive lock of the contact in the shell. Use crimping tool (CPN 371-0382-010) and crimp each interconnect wire in a contact. Using the insertion/extraction tool (CPN 371-8445-010), insert the contact into the proper connector shell hole and press until locked. Refer to figure 2-5.
g. During removal of a contact, use insertion/extraction tool to unlock the contact, and pull the contact out of the connector from the rear.
h. Connection to the antenna is made through a standard BNC connector. Use RG-58A/U coaxial cable in the installation.

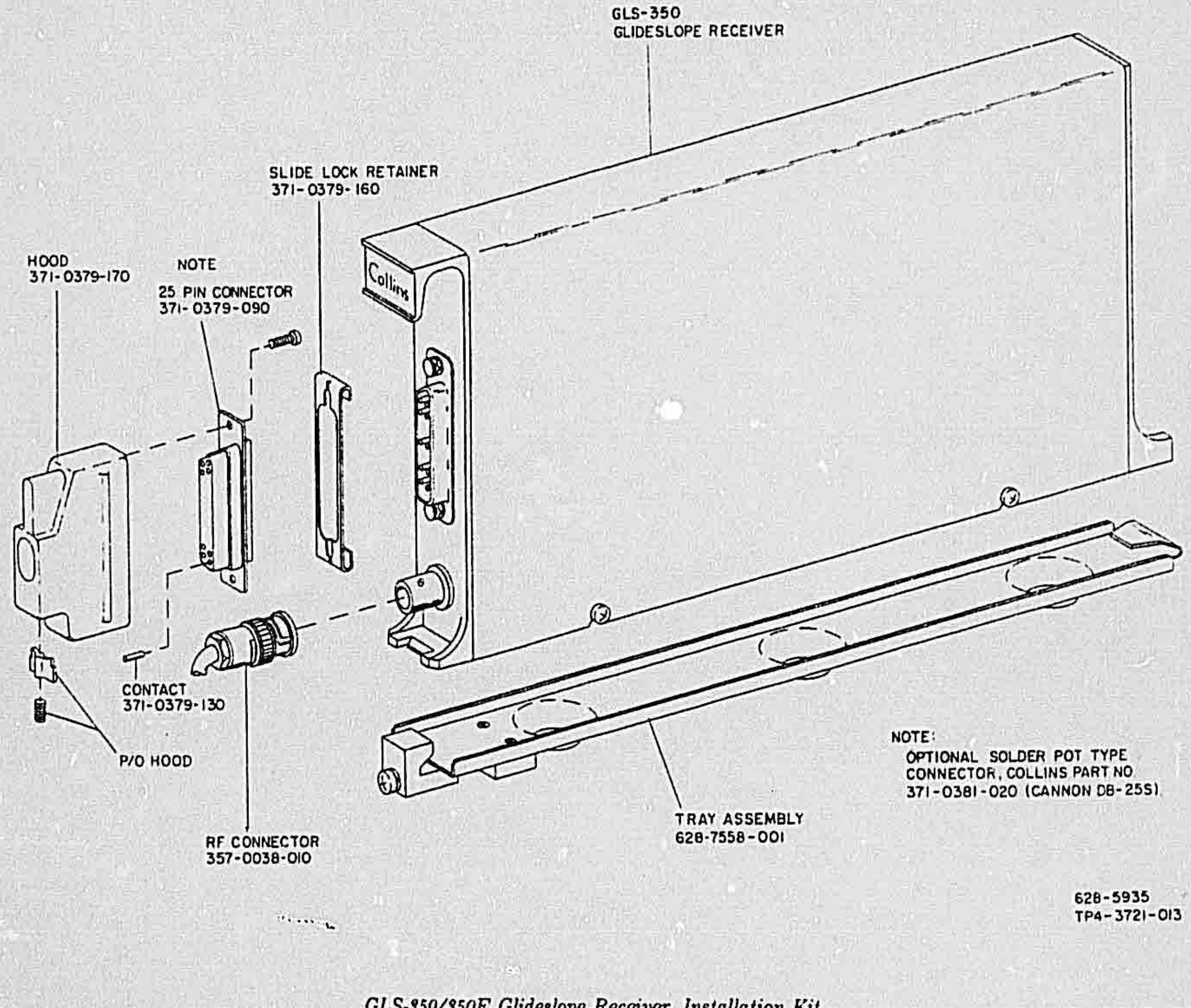
Table 2-1. Special Tools.

DESCRIPTION	MANUFACTURER AND TYPE	COLLINS PART NUMBER
Crimping tool	Cannon, CCT-D*C-1	371-0382-010
Insertion/ extraction tool	Cannon, CIET-20HDB	371-8445-010

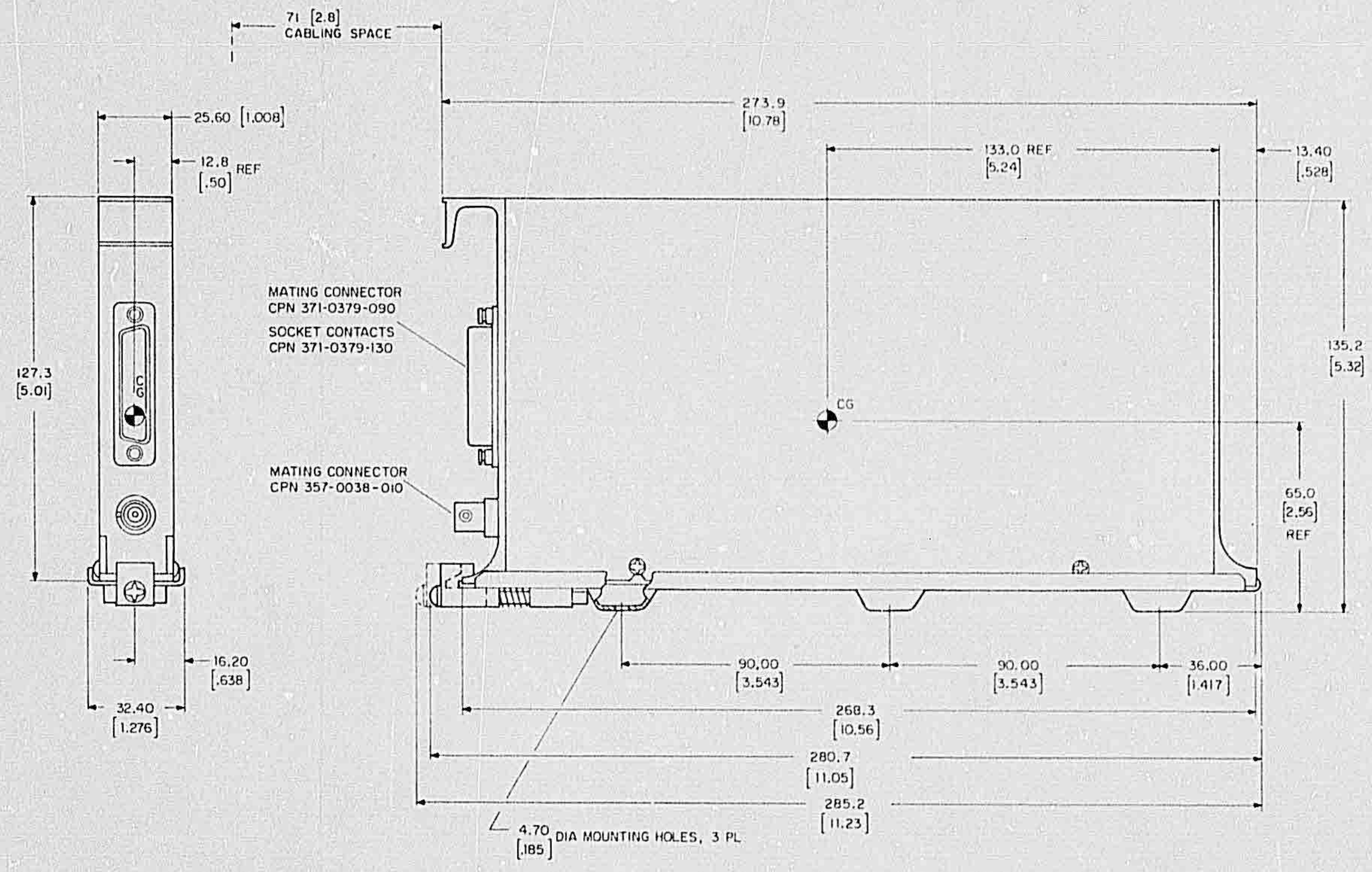
2.6 POSTINSTALLATION CHECKS

The following postinstallation checks are to be performed with the GLS-350/350E and its associated equipment installed in the aircraft. These tests may be made using the aircraft power supply with the engine running, or with auxiliary power applied to the aircraft.

a. Using a ramp test set, generate a glideslope signal at 334.40 MHz.
b. Set navigation receiver to 110.10 MHz.
c. Turn ramp test set DDM control to 0.091 DDM (2-dB ratio) 90 > 150. Observe indicator glideslope deviation bar moves downward just less than 3 dots.
d. Turn ramp test set DDM control to 0.091 DDM (2-dB ratio) 150 > 90. Observe indicator glideslope deviation bar moves upward just less than 3 dots.
e. Set DDM control to 0 (90 Hz = 150 Hz). Glideslope deviation bar should be centered.
f. Observe proper operation of GS warning flag when input signal is removed.



GLS-350/350E Glideslope Receiver, Installation Kit
Figure 2-1

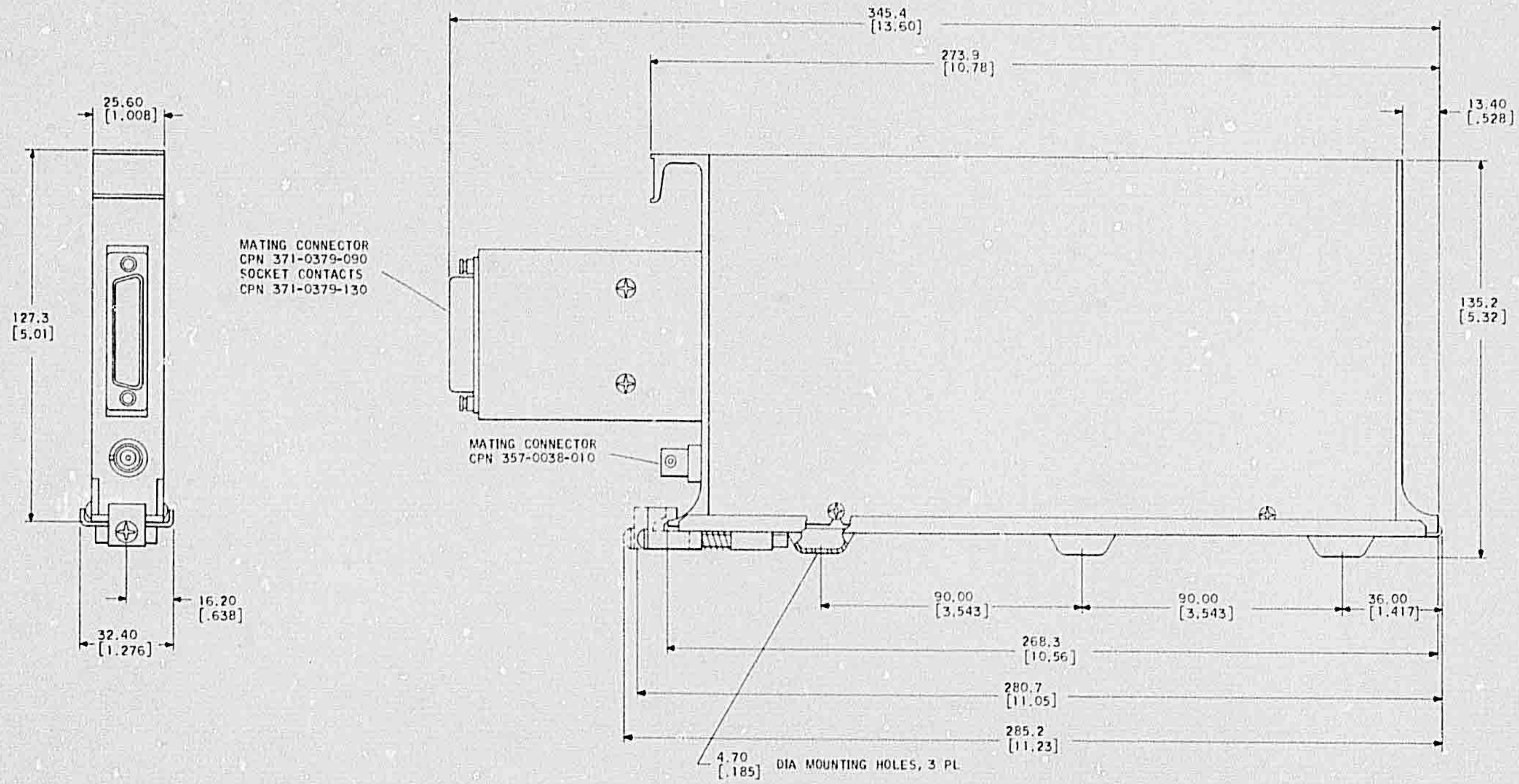


NOTES:

1. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm [INCHES]
2. WEIGHT: 0.91 kg, MAX [2.00 LBS MAX].
3. USE NO. 8 SCREWS FOR MOUNTING TRAY.

628-5700-
TP4-2068-014

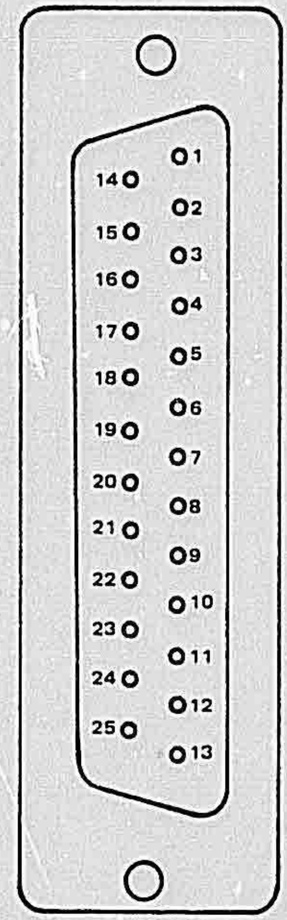
GLS-350 Glideslope Receiver, Outline and Mounting Dimensions
Figure 2-2



NOTES:
1. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm INCHES .
2. WEIGHT: 1.02 kg, MAX [2.25 LBS] MAX .
3. USE NO. 8 SCREWS FOR MOUNTING TRAY.

628-7658

GLS-350E Glideslope Receiver, Outline and Mounting Dimensions
Figure 2-3

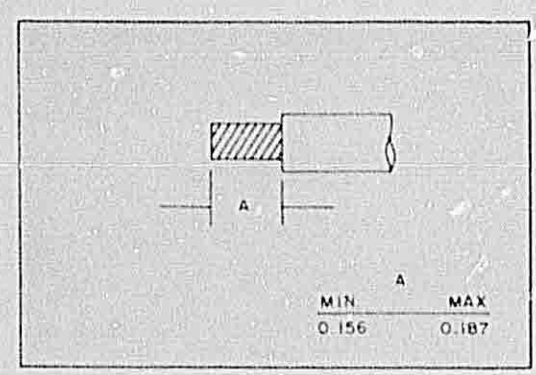


GLS-350/350E MATING CONNECTOR PIN ASSIGNMENTS

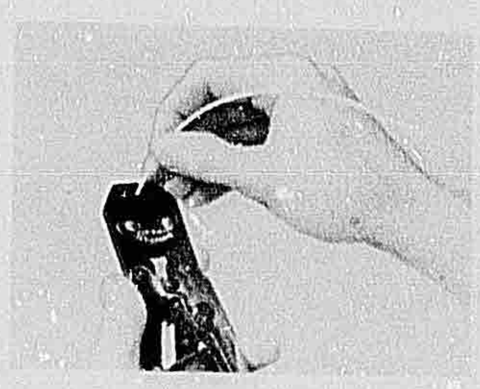
1. POWER GROUND
2. NAV 13.75 V
3. SPARE
4. SPARE
5. SPARE
6. SPARE
7. SPARE
8. SPARE
9. + DOWN
10. + UP
11. - GS FLAG
12. + GS FLAG
13. ILS MODE
14. BCD FREQ 1 MHZ
15. SPARE
16. SPARE
17. BCD FREQ 8 MHZ
18. SPARE
19. BCD FREQ 0.2 MHZ
20. BCD FREQ 0.4 MHZ
21. BCD FREQ 0.8 MHZ
22. BCD FREQ 0.05 MHZ
23. SPARE
24. SPARE
25. BCD FREQ COMMON

628-5711
TP4-2102-011

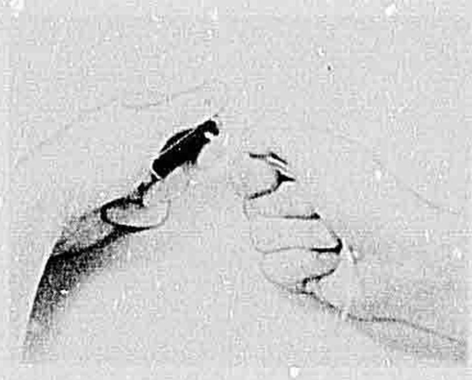
GLS-350/350E, Mating Connector Pin Assignments
Figure 2-4



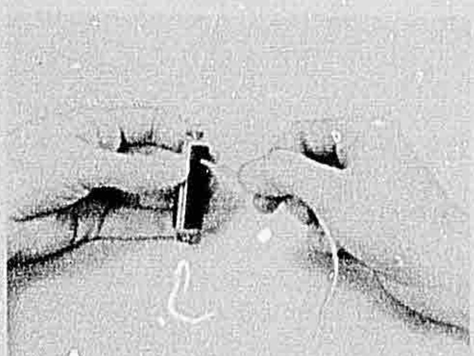
WIRE STRIPPING
1. CUT WIRES TO LENGTH. STRIP INSULATION PER ABOVE ILLUSTRATION. CHECK FOR BROKEN OR FRAYED WIRES.



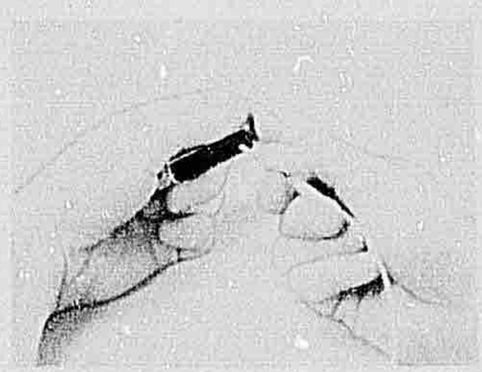
CONTACT CRIMPING
2. INSERT CONTACT AND WIRE INTO PROPER CRIMP TOOL (AND LOCATOR, IF REQUIRED). CRIMP CONTACT TO WIRE. INSPECT CRIMP.



CONTACT INSERTION
3. CENTER WIRED CONTACT IN GROOVE OF INSERTION TOOL,WITH TOOL TIP BUTTING CONTACT SHOULDER. INSERT CONTACT INTO CAVITY UNTIL A POSITIVE STOP IS FELT. INSPECT INSERTION.



4. TO BE SURE CONTACT IS LOCKED SECURELY, PULL BACK LIGHTLY ON WIRE. REPEAT FOR BALANCE OF CONTACTS, WORKING ROW BY ROW ACROSS THE INSULATOR.



CONTACT EXTRACTION
5. PLACE WIRE INTO EXTRACTION TOOL TIP. INSERT TOOL TIP INTO CONTACT CAVITY UNTIL TIP BOTTOMS AGAINST CONTACT SHOULDER, RELEASING TINES. HOLD WIRE AGAINST TOOL WITH FINGER AND REMOVE TOOL AND CONTACT. REPEAT FOR BALANCE OF CONTACTS.

628-5699-001
TP4-2067-017

Use of Crimping and Insertion/Extraction Tools
Figure 2-5

ERRATA SHEET 1 TO INSTALLATION SECTION
FOR
GLS-350/350E GLIDESLOPE RECEIVER

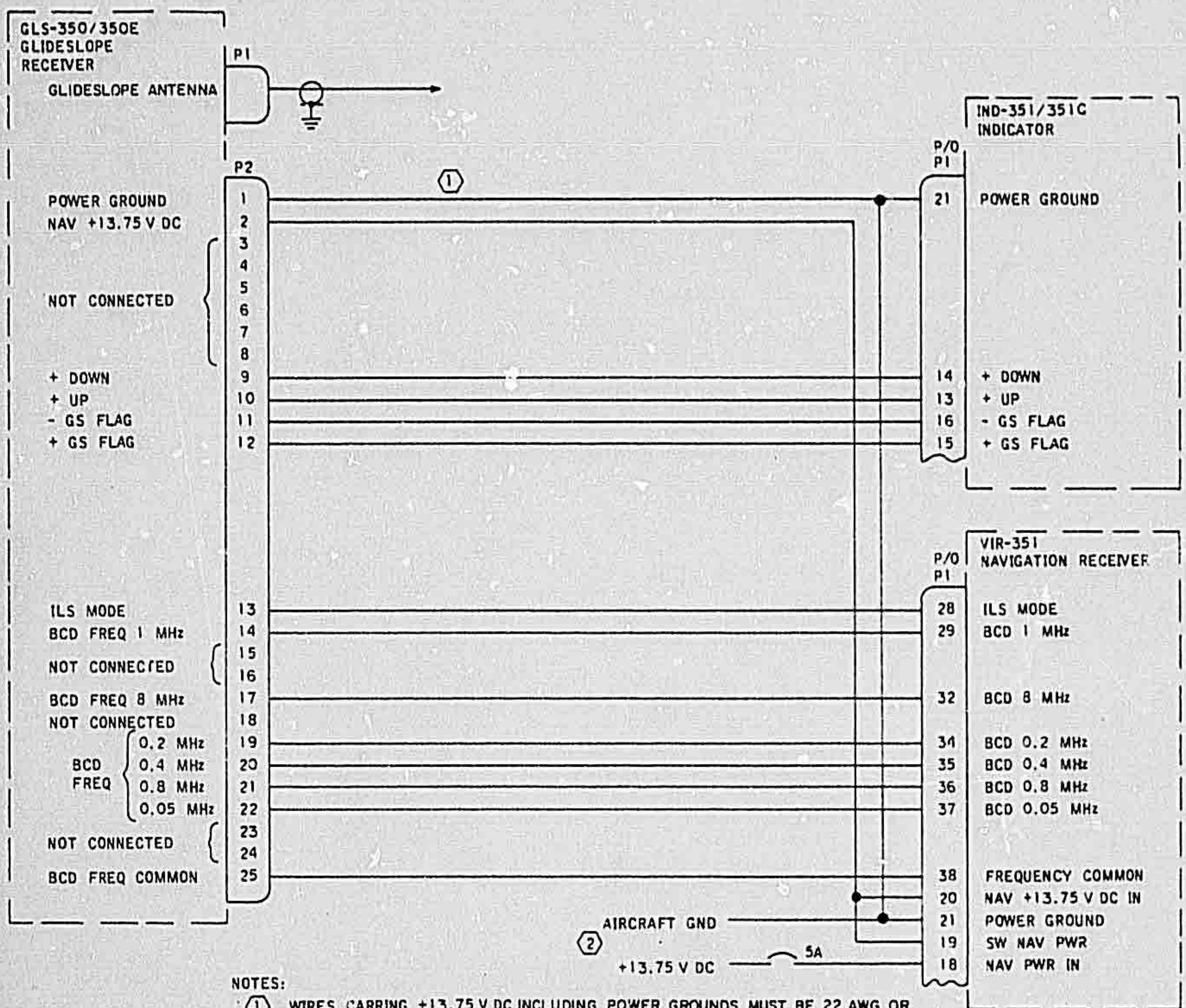
(523-0766023-004118, dated 9 June 1982)
(Located in MKR-350 Marker Receiver, MKL-350/351 Remote Marker Lights, AUD-250/250H/251H Audio Panel, AMR-350/350H Audio/Marker Panel, and GLS-350/350E Glideslope Receiver, Instruction Book, 523-0766031-10511A)

This errata sheet is being issued to correct the value of the circuit breaker connected to P1-18 of the VRI-351 Navigation Receiver on the GLS-350/350E Glideslope Receiver interconnect wiring diagram, figure 2-6, shown on page 2-8 of the GLS-350/350E installation section.

Insert this errata sheet facing page 2-8 of the GLS-350/350E Glideslope Receiver installation section.

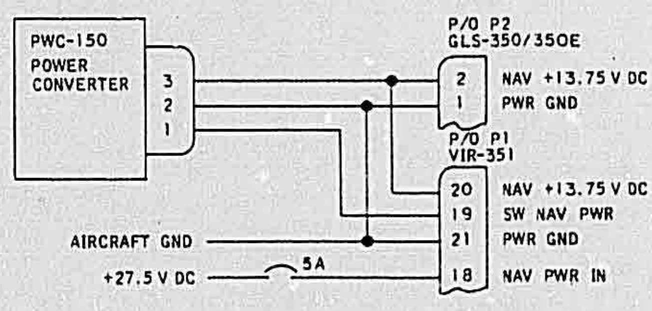
Make the following changes to the GLS-350/350E Glideslope Receiver Interconnect Wiring Diagram, figure 2-6, shown on page 2-8:

> Change the value of the circuit breaker connected to P1-18 of the VIR-351 Navigation Receiver (for both +13.75 V Dc and +27.5 V Dc operation) from 5A as shown to the new value of <u>2A</u>.



NOTES:

1. WIRES CARRING +13.75 V DC INCLUDING POWER GROUNDS MUST BE 22 AWG OR LARGER, ALL OTHERS MUST BE 24 AWG OR LARGER.
2. FOR +27.5 V DC VOLT OPERATION, CONNECT AS FOLLOWS



628-5819
TP4-3021-014

GLS-350/350E Glideslope Receiver, Interconnect Wiring Diagram
Figure 2-6

Collins GLS-350/350E Glideslope Receiver

Rockwell International

operation

Collins General Aviation Division

Printed in USA

523-0766024-003118
3rd Edition, 9 June 1982

Operation

GLS-350/350E

523-0766024-003118

table of contents

NOTICE: This section replaces second edition dated 15 June 1976.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	9 Jun 82
*List of Effective Pages	9 Jun 82
*3-1	9 Jun 82
3-2 Blank	14 Feb 75

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None				
2nd Ed	15 Jun 76		None				
3rd Ed	9 Jun 82		GLS-350: SB 1, 2 SIL 1-76; GLS-350E: SB 1 SIL 1-76				

section III
operation

3.1 GENERAL

The GLS-350/350E Glideslope Receiver is channeled automatically by the VIR-351 Navigation Receiver. Glideslope frequencies and localizer frequencies are paired; therefore both signals will be received simultaneously when a localizer frequency is selected on the VIR-351.

Warning

> The GLS-350/350E Glideslope Receiver has been designed to exhibit a very high degree of functional integrity. However, the user must recognize that it is not practical to provide monitoring and/or self-test for all conceivable system failures. However unlikely, it is possible that erroneous operation could occur without a fault indication. It is the responsibility of the pilot to detect such an occurrence by means of cross-checks with redundant or correlated information available in the cockpit.

When the glideslope warning flag is out of view, information displayed by the indicator will be reliable.

When flying the glidepath, the horizontal deviation bar will be centered. Deviation from the glidepath will be reflected by movement of the deviation bar. To maintain descent on the glidepath, the pilot must keep the deviation bar centered. An up or down deflection requires the pilot to correct in the direction the deviation bar moves. In brief, the pilot must pull up when the deviation bar is above center, or increase descent rate when the deviation bar is below center.

Warning

> Indications other than those received when properly positioned for a front course ILS approach should be ignored. These spurious glideslope indications may at times appear to be valid glideslope indications. Never make an ILS approach in any manner except in accordance with an FAA-approved approach procedure. Maintain cross-check with barometric altitude throughout approaches, and never descend below minimum altitudes for the approach regardless of any glideslope indications until safe landing by visual reference is assured.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	9 Jun 82
*List of Effective Pages	9 Jun 82
*4-1	9 Jun 82
4-2 thru 4-9	15 Jun 76
4-10 Blank	14 Feb 75

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None				
2nd Ed	15 Jun 76		None				
3rd Ed	9 Jun 82		GLS-350: SB 1, 2, SIL 1-76; GLS-350E: SB 1, SIL 1-76				

Collins GLS-350/350E Glideslope Receiver

Rockwell International

theory

Collins General Aviation Division

Printed in USA

523-0766025-003118
3rd Edition, 9 June 1982

table of contents

NOTICE: This section replaces second edition dated 15 June 1976.

section IV
theory

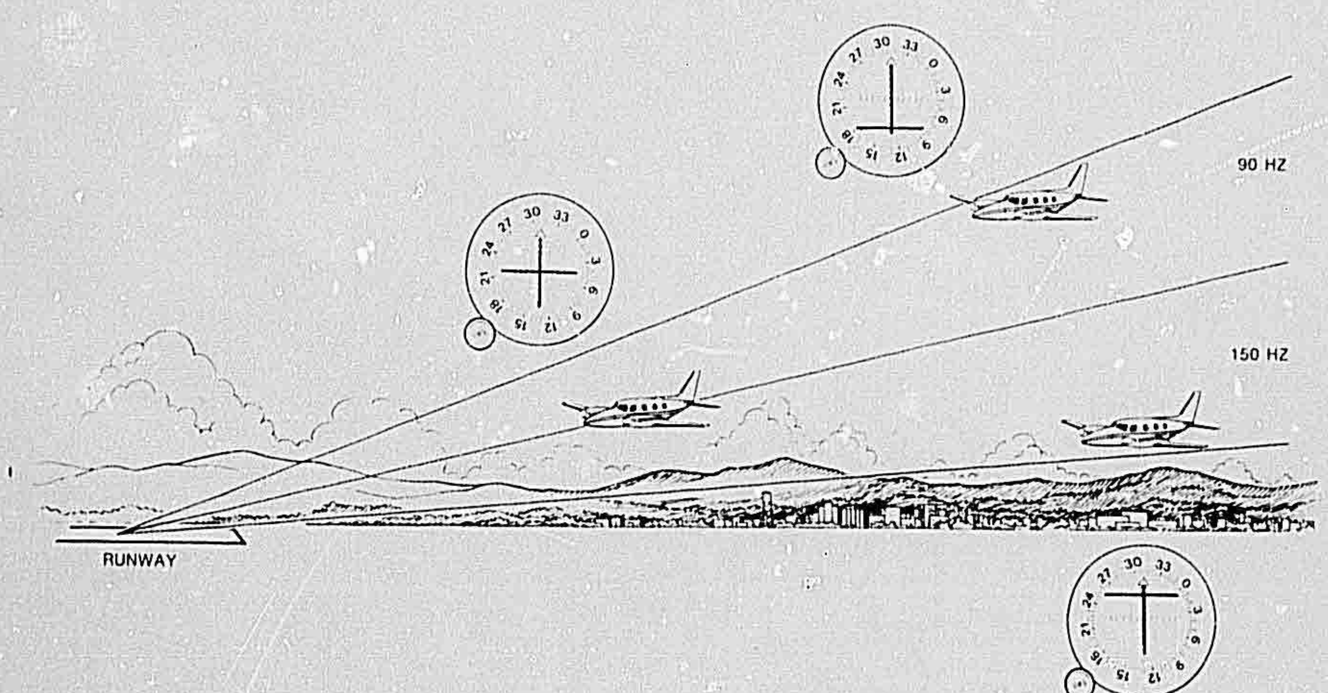
4.1 GENERAL

The GLS-350/350E Glideslope Receiver principles of operation are discussed in functional segments. A brief discussion of glideslope system principles precedes the circuit theory.

4.2 GLIDESLOPE SYSTEM PRINCIPLES (Refer to figure 4-1.)

The glideslope signal is radiated by complex antenna arrays located near the approach end of the airport runway. The glideslope signal is radiated to produce two intersecting lobes, one above the other. The upper lobe is predominantly modulated with 90 Hz, and the lower is predominantly modulated with 150 Hz. On a line at an angle of 2.5 to 3 degrees from the ground, the two audio signals are equal in amplitude. This line of equal modulation defines the glidepath. The GLS-350/350E detects and compares the 90- and 150-Hz signals and applies drive to the glideslope deviation indicator.

The glidepath provides the pilot with vertical guidance when making an approach to the runway. If the aircraft is on the glidepath, equal amplitudes of both 90 and 150 Hz are received, and the glideslope deviation bar is centered. If the aircraft is above the glidepath, 90-Hz modulation predominates and the deviation bar moves downward. If below the glidepath, 150 Hz predominates and the deviation bar moves upward.



Flying the Glidepath
Figure 4-1

4.3 GLS-350/350E BASIC PRINCIPLES OF OPERATION (Refer to figure 4-2.)

4.3.1 Receiver

The GLS-350/350E Glideslope Receiver is a double conversion, superheterodyne receiver that receives rf signals in the 329.15- through 335.0-MHz range in 150-kHz increments. The rf input signal is coupled through a 3-pole preselector to the first mixer where it is combined with the synthesized first injection frequency. The synthesizer output varies from 269.84 through 275.69 MHz depending upon the selected frequency. The 59.31-MHz output of the first mixer is amplified and applied to the second mixer where it is combined with a second injection signal of 70.01-MHz frequency supplied by a crystal oscillator. The resulting 10.7-MHz intermediate frequency is coupled through a crystal filter to provide adjacent channel selectivity, and then to the second intermediate-frequency stages. AGC voltage controls the gain of all three if amplifier stages.

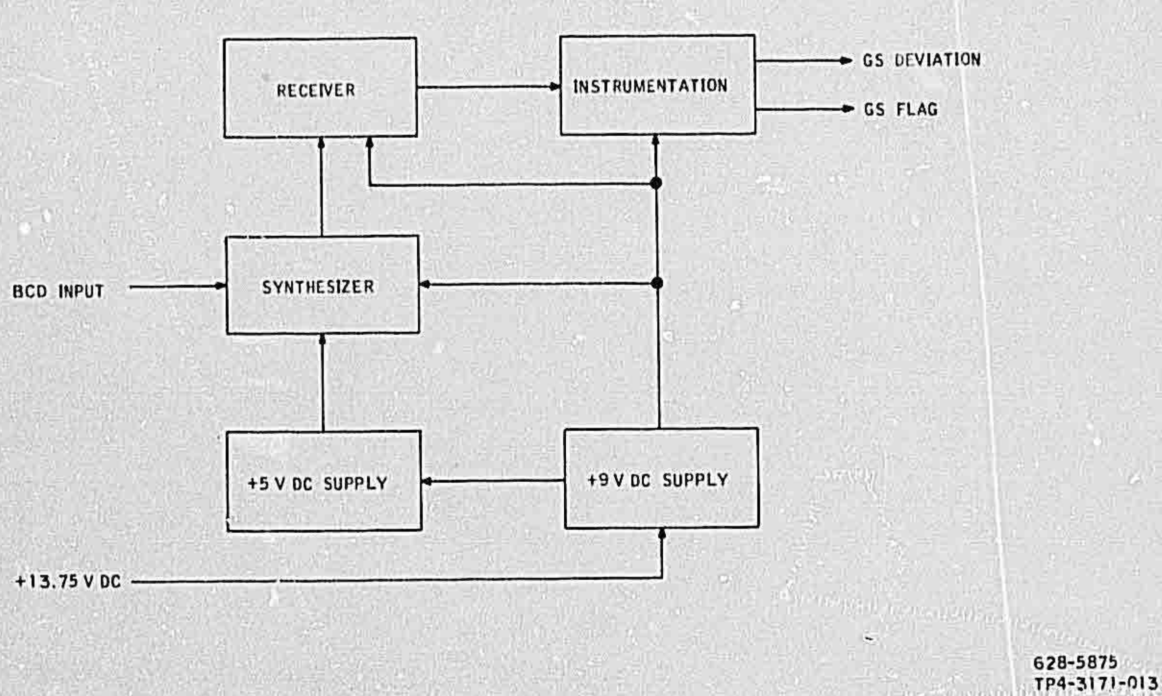
The detector recovers the composite modulation signal and produces a dc voltage proportional to the input level. This dc voltage is amplified and compared to a fixed reference voltage by the AGC circuit. The audio amplifier supplies the composite modulation signal to the instrumentation circuitry that provides deviation and flag outputs.

4.3.2 Instrumentation

The detected output signal is coupled to the instrumentation circuitry through course width adjustment R131, and centering adjustment R133, to two active filters tuned to 90 and 150 Hz. The outputs of these filters are detected and amplified to drive the deviation and warning flag indicators.

4.3.3 Synthesizer

The synthesizer is a single-loop digital frequency synthesizer that phase locks a voltage-controlled oscillator (vco) operating over the 269.84- through 275.69-MHz frequency range to a single 2.4-MHz crystal oscillator that determines the overall frequency stability of the synthesizer.



GLS-350/350E Glideslope Receiver, Basic Block Diagram
Figure 4-2

The digital frequency synthesizer provides the 269.84- through 275.69-MHz injection signal to the receiver first mixer.

The synthesizer also contains a crystal oscillator operating at 70.01 MHz. The oscillator provides the injection signal to the receiver second mixer, and this 70.01-MHz signal is quadrupled to generate the synthesizer offset frequency.

4.3.4 Power Supplies

There are two power supplies contained within the GLS-350/350E.

The main supply regulates the +13.75-V dc input voltage down to +9 V dc for use in the glideslope receiver section. This +9 V dc is used by the +5-V dc supply contained in the synthesizer section that reduces its input to +5 V dc. The +5-V dc output is used within the synthesizer as well as the +9-V dc output.

4.4 DETAILED PRINCIPLES OF OPERATION

4.4.1 Receiver (Refer to figures 4-3 and 6-1.)

The GLS-350/350E is an electronically tuned, dual conversion receiver operating in the 329.15- through 335.00-MHz range.

4.4.1.1 Frequency Selection and First Mixer

The antenna input signal is filtered in a 3-pole preselector, then coupled to dual gate MOSFET mixer Q101 where it is combined with the synthesizer output. The mixing action of Q101 yields a 59.31-MHz intermediate frequency that is coupled to the first if amplifier, Q102.

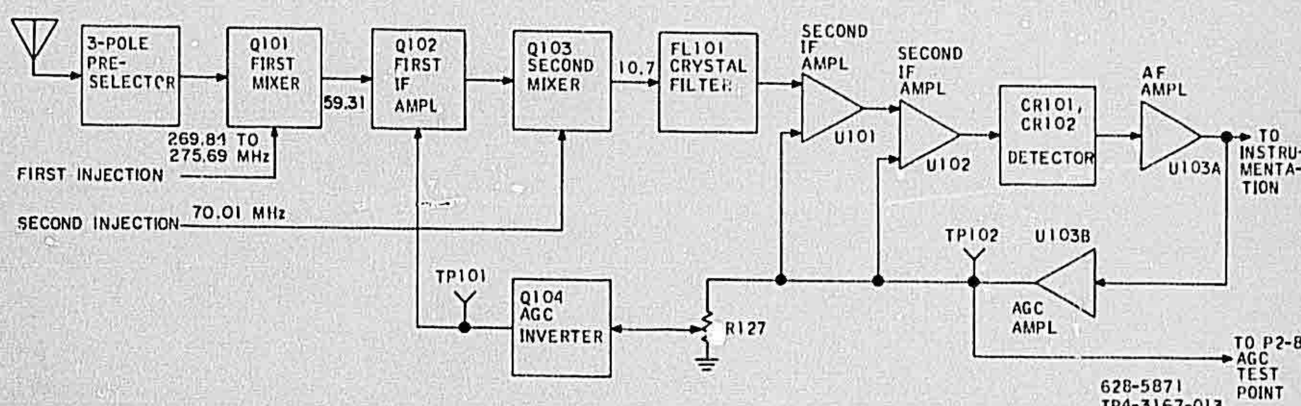
4.4.1.2 First IF and Second Mixer

First intermediate-frequency transistor Q102, a dual gate MOSFET, is gain controlled by varying its transconductance. AGC inverter Q104 reduces the MOSFET control gate bias as the signal level increases. The second mixer, Q103, combines the 59.31-MHz first if output with the 70.01-MHz crystal oscillator signal to produce a 10.7-MHz second intermediate frequency. The output of the second mixer is coupled to crystal filter FL101 that provides the required adjacent channel rejection for 150-kHz channel spacing.

4.4.1.3 10.7-MHz IF and Detection

After filtering, the 10.7-MHz signal is amplified in two gain-controlled if amplifier integrated circuits U101 and U102. These integrated circuits amplify the comparatively weak signal at the output of the crystal filter to a level sufficient to drive detector amplifier U103A. Both stages of if amplification are gain controlled by the AGC feedback loop.

Diode CR102 is an active detector that supplies the detected composite audio to af amplifier U103A. Diodes CR101 and CR115 temperature compensate amplifier U103A operation by maintaining a constant bias at the input. Amplifier U103A drives the AGC feedback loop and instrumentation circuits.



GLS-350/350E Receiver, Functional Block Diagram
Figure 4-3

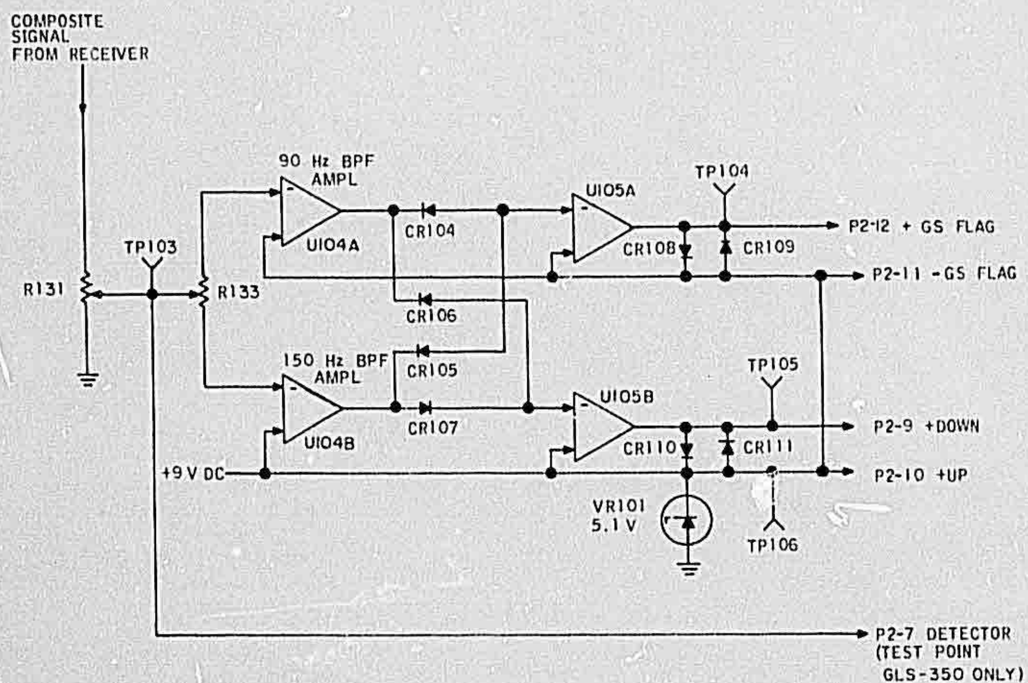
4.4.1.4 AGC Operation

The detector output (composite audio plus dc) is applied to the inverting input of AGC amplifier U103B. The noninverting input is connected to a reference voltage established by resistors R124, R125, and R172. Diode CR103 sets the dc gain of the AGC amplifier while capacitors C136 and C135 eliminate audio output. When the input of the AGC amplifier deviates from the reference voltage, the output of U103B changes the receiver gain to reestablish the level of the reference voltage. AGC amplifier U103B in this manner gain controls both stages of second if amplification and the first stage of if amplification through AGC inverter Q104. Thermistor RT101 provides temperature compensation for AGC by varying the base bias applied to AGC inverter Q104.

4.4.2 Instrumentation (Refer to figures 4-4 and 6-1.)

The composite signal from the af amplifier is coupled through the course width adjustment, R131, into two active filters. Amplifier U104A and its associated components form an active 90-Hz bandpass filter. Amplifier U104B and its associated components form a 150-Hz bandpass filter. The 90- and 150-Hz components are separated and amplified by these two filters. The outputs of the 90- and 150-Hz bandpass filters are applied to detector diodes CR104 and CR106 for the 90 Hz and to CR105 and CR107 for the 150 Hz. Diode CR106 passes the negative-going portion of the 90-Hz signal and diode CR107 conversely passes the positive-going portion of the 150-Hz signal. These two rectified signals are summed at the inverting input of deviation amplifier U105B. When the aircraft is flying the glidepath, equal amounts of 90- and 150-Hz signals are received, and the half-wave rectified signals cancel, producing zero deflection. If the aircraft rises above the glidepath, a stronger 90-Hz signal will be received. Since the detector outputs are applied to the inverting input of U105B, its output will become more positive producing downward deflection.

Diodes CR104 and CR105 apply the negative portion of both the 90- and 150-Hz signals to the inverting input of flag amplifier U105A. The positive output of



GLS-350/350E Instrumentation, Functional Block Diagram
Figure 4-4

U105A is used to bias the glideslope warning flag out of view. Presence of the glideslope warning flag indicates the aircraft is receiving unreliable glideslope information. This condition exists when the detected 90- or 150-Hz signals are no longer present at the flag amplifier input.

Diodes CR108, CR109, CR110, and CR111 limit the maximum current that may flow in the deviation and flag loads by limiting the maximum voltage across them.

4.4.3 Synthesizer (Refer to figures 4-5 and 6-2.)

The digital frequency synthesizer uses a single phase-locked loop to generate the 269.84- to 275.69-MHz first injection frequency. A single voltage-controlled oscillator (vco) covers the frequency range. Frequency control of the synthesizer is accomplished by parallel bcd control information provided by the VIR-351 Navigation Receiver. Combinational logic is used to decode the frequency control information to effect the required frequency pairings. Figure 4-7 lists the glideslope-localizer frequency pairings with the associated variable divider control code. Frequency stability is determined by a 2.4-MHz crystal-controlled frequency standard oscillator.

4.4.3.1 Phase-Locked Loop Fundamentals (Refer to figure 4-6.)

Basically, a digitally stabilized master oscillator loop consists of a voltage-controlled oscillator (vco), a variable ratio digital divider, a frequency standard operating at the desired frequency spacing, a phase detector, and a low-pass filter. The vco signal is applied to the variable ratio divider where its frequency is divided by the ratio, N. The divider output is one pulse for every N cycles of the input. The divider output is applied to the digital phase detector where it is compared with the reference frequency, f_r. The phase detector error signal is low-pass filtered to control the vco frequency. The low-pass filter provides high attenuation to harmonics of f_r while allowing the low-pass correction components to hold the vco on the desired frequency. Thus, the frequency of the vco, when phase locked, will always be equal to Nf_r. Therefore, since the dividing ratio, N, is variable in integral steps, the vco frequency is variable in integral multiples of f_r.

4.4.3.2 Variable Ratio Divider

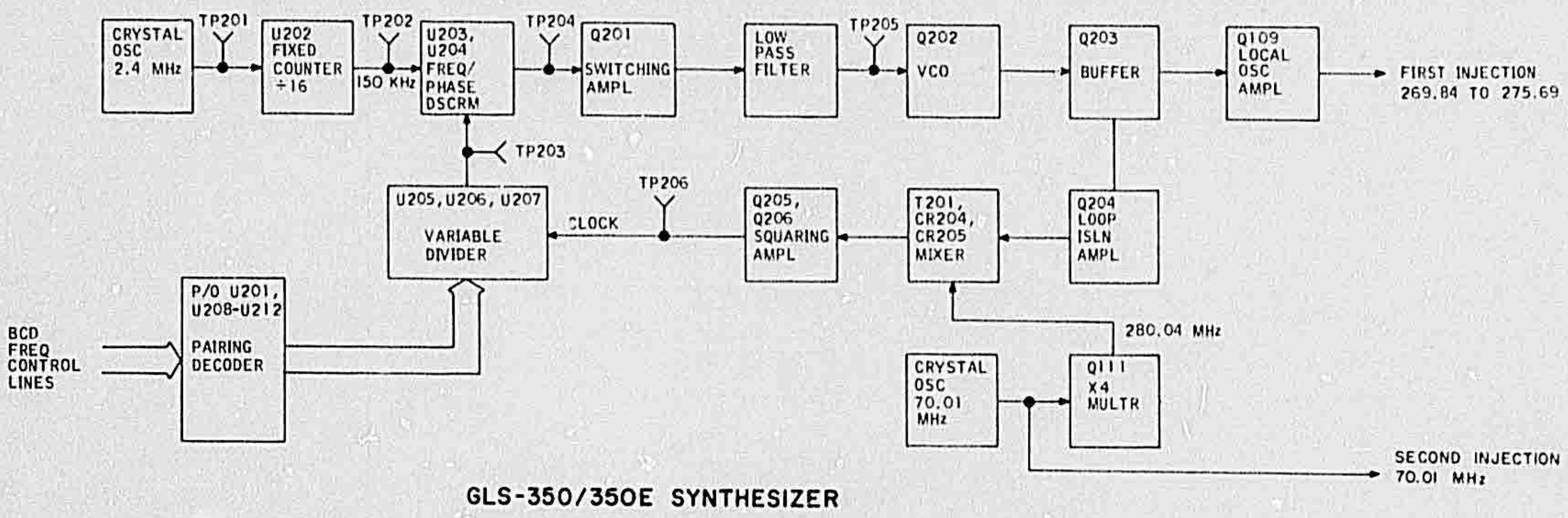
A portion of the vco signal is applied to loop isolation amplifier Q204. The isolation amplifier is provided drive by coupling to the vco tank circuit. The relatively low impedance of the collector circuit provides additional isolation of the synthesizer from the mixer injection signals and products. The loop isolation amplifier output is fed to the mixer where it is mixed with a 280.04-MHz translating frequency to produce an intermediate frequency in the range of 10.2 to 4.35 MHz. Since the translating frequency is on the high side of the signal from the vco, the intermediate frequency decreases as the vco frequency increases. This results in the variable divider ratio decreasing as the output frequency increases. This reduces the loop gain and bandwidth variations since the vco sensitivity and the division ratio change in the same direction and the gain and bandwidth are proportional to their ratio. The lower intermediate frequency allows the use of lower speed integrated circuits in the variable divider.

The mixer output is LC filtered and squared by transistors Q205 and Q206. The variable divider network divides the output of squaring amplifier Q206 down to approximately 150 kHz for comparison with the 150-kHz reference frequency. A 150-kHz reference frequency is necessary because each increment change in the variable divider will cause the vco frequency to change by an amount equal to the reference frequency. The reference frequency must therefore be equal to the 150-kHz channel spacing. The variable divider has a division ratio that varies from 68 to 29 to accommodate the forty 150-kHz increments of the 10.2- to 4.35-MHz variable if signal.

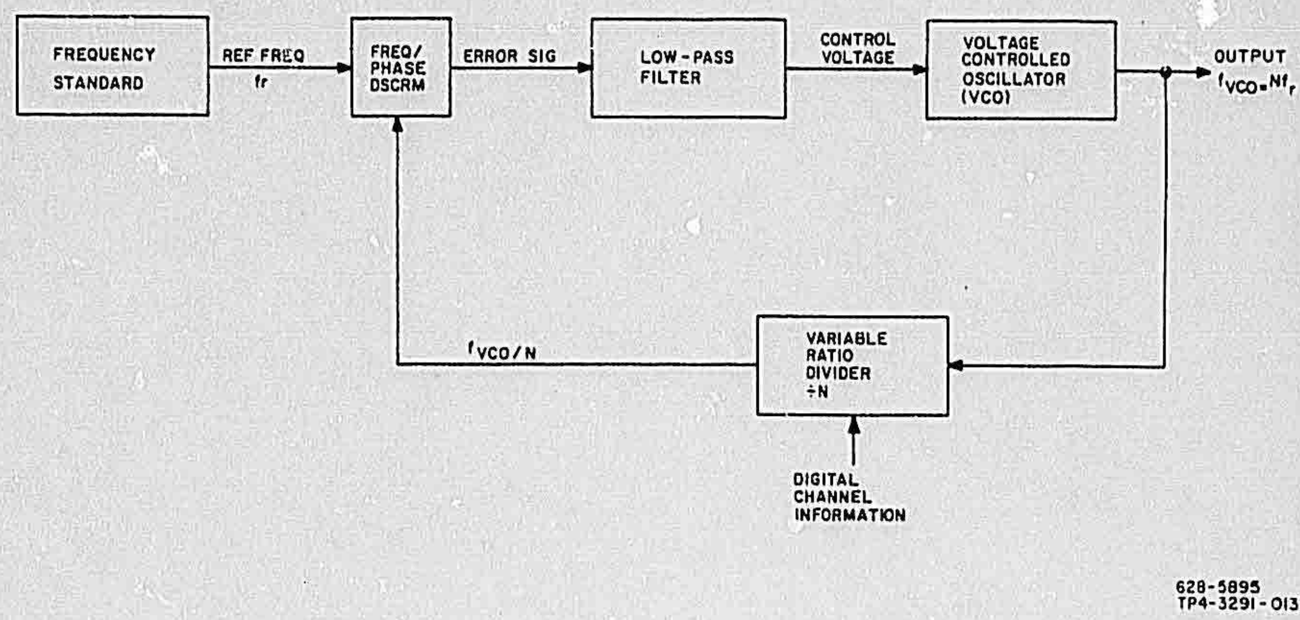
The variable divider consists of two programmable binary counters whose basic count is set at 70. The basic count is then shortened by subtracting a number of counts as determined by the pairing decoder (figure 4-7). As previously stated the ratio varies from 68 to 29 inclusive.

4.4.3.3 Frequency/Phase Discriminator

The frequency/phase discriminator consists of a combination of J-K flip-flops and NAND gates U204. The 150-kHz input from the variable ratio divider sets the phase detector high. The 150-kHz input from the fixed divider resets the phase detector output low. Switching occurs on the leading edge of the pulses. During normal operation, the pulses alternate between the set and reset inputs. When the loop is not phase locked, as when changing frequency, the circuit acts as a frequency discriminator and produces a constant dc output level that is either high or low, depending on the desired direction of tuning. This frequency discrimination prevents the loop from locking in



GLS-350/350E Synthesizer, Functional Block Diagram
Figure 4-5



Digitally Stabilized Loop Master Oscillator, Block Diagram
Figure 4-6

spurious phase modes and also forces the loop capture range to be equal to the holding range.

4.4.3.4 VCO Tuning

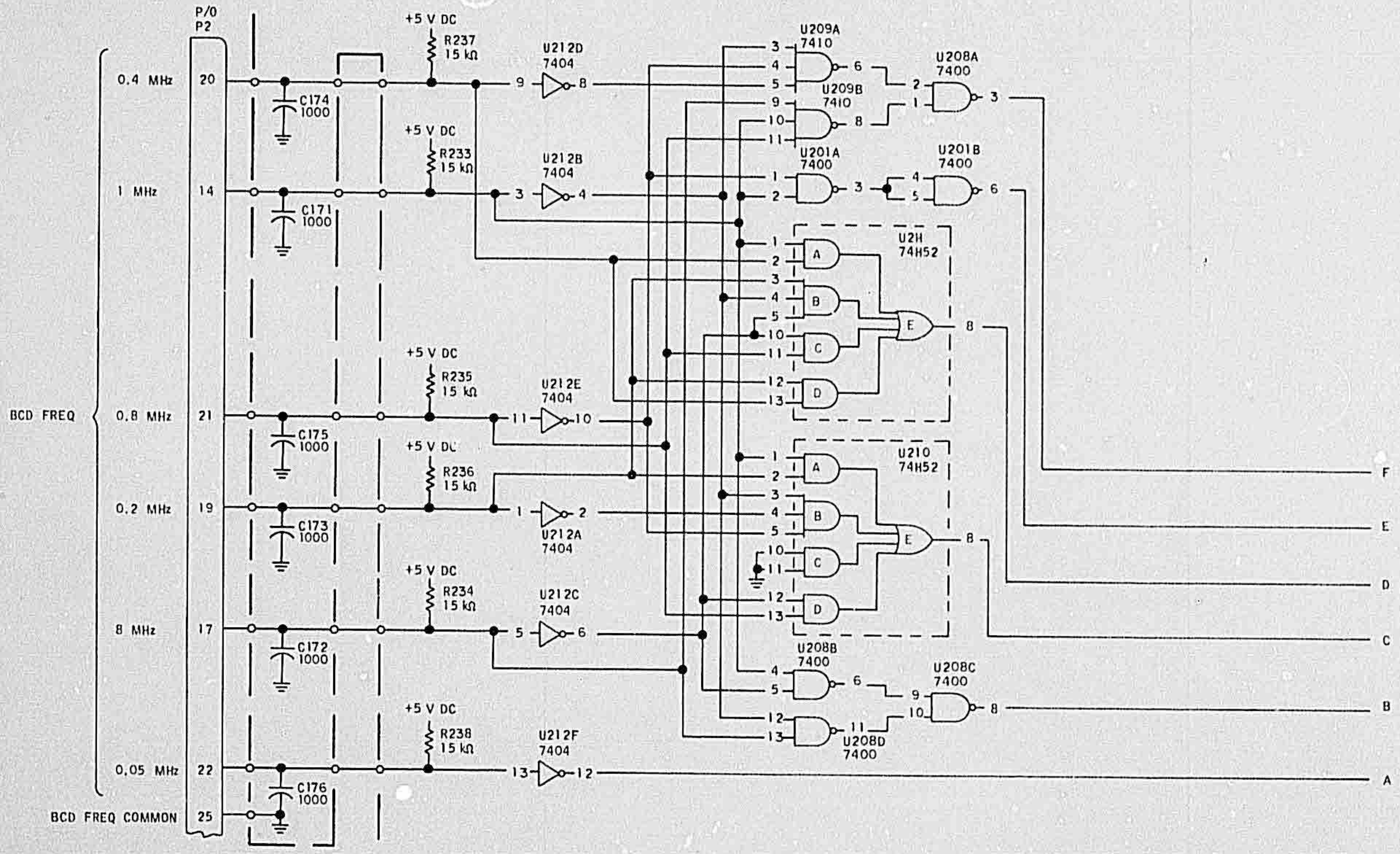
Switching amplifier Q201 raises the discriminator output signal to the level required to tune the vco over the frequency range. The switching amplifier output is fed to a low-pass filter that removes any switching rate components. The resulting dc output voltage from the filter controls the voltage-variable capacitor in the vco to effect phase lock. The phase difference between the 150-kHz reference and the output of the variable ratio divider controls the vco frequency. As the phase difference increases, the tuning voltage changes, altering the vco frequency. Phase lock occurs when the phase difference becomes constant at the value necessary to produce a vco frequency that, when divided, produces 150 kHz at the frequency/phase discriminator. The division ratio of the variable ratio divider determines the vco frequency where phase lock occurs. If the division ratio of the variable ratio divider changes or the vco frequency drifts, the phase difference will change, causing the vco frequency to change until the phase lock condition is again met.

4.4.3.5 Frequency Standard

The reference signal for the frequency/phase discriminator is produced by a 2.4-MHz crystal oscillator and a digital divider having a fixed divide ratio of 16. These two stages produce the 150-kHz frequency standard used by the frequency/phase discriminator for comparison with the output of the variable ratio divider.

4.4.3.6 Translating Frequency

The 280.04-MHz translating signal is supplied by a crystal oscillator operating at a basic frequency of 70.01 MHz. The output of the oscillator is quadrupled to arrive at the 280.04-MHz signal. The 70.01-MHz basic oscillator frequency is the injection signal for the receiver second mixer.



GLIDESLOPE FREQUENCY MHz	LOCALIZER FREQUENCY MHz	GLIDESLOPE FREQUENCY CONTROL 6 WIRES (DECODER OUTPUT) F	E	D	C	B	A
329.15	108.95	0	0	0	0	1	0
329.30	108.30	0	0	0	0	1	1
329.45	110.55	0	0	0	1	0	0
329.60	110.50	0	0	0	1	0	1
329.75	108.55	0	0	0	1	1	0
329.90	108.50	0	0	0	1	1	1
330.05	110.75	0	0	1	0	0	0
330.20	110.70	0	0	1	0	0	1
330.35	108.75	0	0	1	0	1	0
330.50	108.70	0	0	1	0	1	1
330.65	110.95	0	0	1	1	0	0
330.80	110.90	0	0	1	1	0	1
330.95	111.95	0	0	1	1	1	0
331.10	111.90	0	0	1	1	1	1
331.25	109.15	0	1	0	0	0	0
331.40	109.10	0	1	0	0	0	1
331.55	111.15	0	1	0	0	1	0
331.70	111.10	0	1	0	0	1	1
331.85	109.35	0	1	0	1	0	0
332.00	109.30	0	1	0	1	0	1
332.15	111.35	0	1	0	1	1	0
332.30	111.30	0	1	0	1	1	1
332.45	109.55	0	1	1	0	0	0
332.60	109.50	0	1	1	0	0	1
332.75	111.55	0	1	1	0	1	0
332.90	111.50	0	1	1	0	1	1
333.05	109.75	0	1	1	1	0	0
333.20	109.70	0	1	1	1	0	1
333.35	111.75	0	1	1	1	1	0
333.50	111.70	0	1	1	1	1	1
333.65	109.95	1	0	0	0	0	0
333.80	109.90	1	0	0	0	0	1
333.95	108.35	1	0	0	0	1	0
334.10	108.30	1	0	0	0	1	1
334.25	110.15	1	0	0	1	0	0
334.40	110.10	1	0	0	1	0	1
334.55	108.15	1	0	0	1	1	0
334.70	108.10	1	0	0	1	1	1
334.85	110.35	1	0	1	0	0	0
335.00	110.30	1	0	1	0	0	1

628-5820
TP4-3066-014

Decoder Simplified Schematic/GS/LOC Frequency Pairings
Figure 4-7

4.4.4 Power Distribution (Refer to figures 6-1 and 6-2.)

4.4.4.1 +9-V DC Series Regulator (Refer to figure 4-8.)

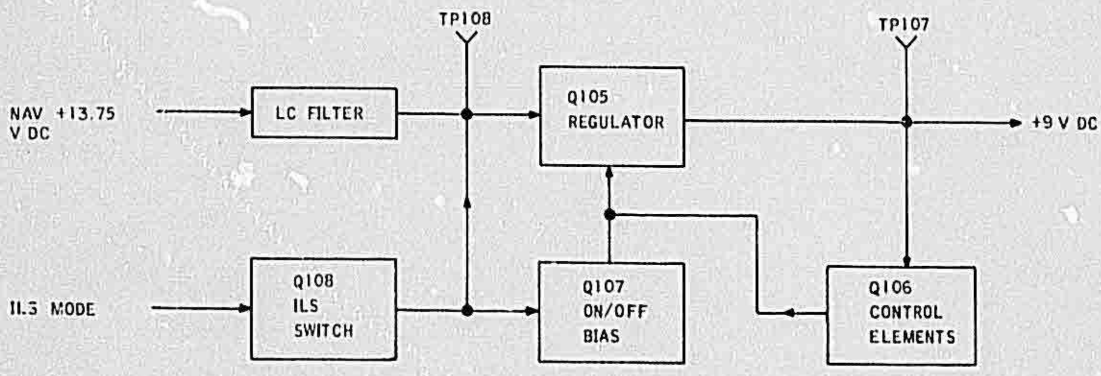
Selecting an ILS frequency activates the +9-V dc series regulator.

The +13.75-V dc input from the VIR-351 Navigation Receiver is filtered and applied to regulator transistor Q105. No output occurs until an ILS frequency is selected, which places a ground at the base of resistor of switch transistor Q108. Transistor Q108 then conducts and turns on transistor Q107. With Q107 conducting, an output will be present at the emitter of regulator Q105.

Regulation is accomplished by varying the base bias voltage of regulator Q105. Control transistor Q106 monitors the output voltage and varies the base bias of Q106 to maintain the +9-V dc output.

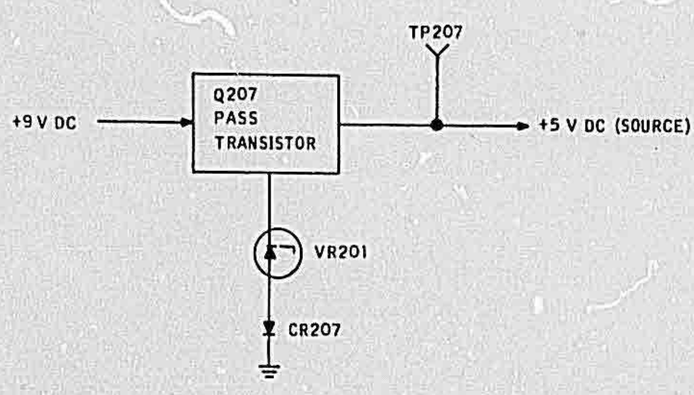
4.4.4.2 +5-V DC Supply (Refer to figure 4-9.)

The regulated output of the +9-V dc supply is applied to the +5-V dc supply in the synthesizer section. Pass transistor Q207 supplies the +5-V dc output. A zener diode, VR201, is the stable voltage reference that effectively controls the pass transistor output.



628-5873
TP4-3169-012

+9-V DC Series Regulator, Functional Block Diagram
Figure 4-8



628-5874
TP4-3170-012

+5-V DC Supply, Functional Block Diagram
Figure 4-9

Maintenance

Collins GLS-350/350E Glideslope Receiver

Rockwell International

maintenance

Collins General Aviation Division

Printed in USA

523-0766026-105118
5th Edition, 9 June 1982
1st Revision, 30 July 1984

GLS-350/350E

table of contents

523-0766026-105118

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL.
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None				
2nd Ed	1 Sep 75		GLS-350 SB 1				
3rd Ed	15 Jun 76		GLS-350 SB 1, SIL 1-76 GLS-350E SIL 1-76				
1	15 Nov 76		Same as 3rd edition				
4th Ed	1 Jun 78		Same as 3rd edition				
5th Ed	9 Jun 82		GLS-350: SB 1, 2, SIL 1-76; GLS-350E: SB 1, SIL 1-76				
1	30 Jul 84		Same as above				

section V
maintenance

5.1 GENERAL

This section provides the information necessary to maintain, repair, test, and align the GLS-350/350E Glideslope Receiver.

Table 5-1 is a list of tools required for servicing. Table 5-2 is a list of test equipment needed to accomplish alignment and repair of the GLS-350/350E.

Caution

Remove power before removing or installing the GLS-350/350E in the aircraft.

5.2 REPLACEMENT OF INTEGRATED CIRCUITS

5.2.1 *Troubleshooting and Replacement of MOS/CMOS Devices*

All MOS devices are subject to damage by electrostatic charges. The very high resistance of the oxide insulation used within the MOS imposes a negligible load on electrostatic potentials and therefore does not provide an effective discharge path for sources of static electricity. Although some MOS devices do contain integral gate-protection systems, good practice dictates careful handling of all MOS packages. The following precautions should be observed when handling MOS devices and are applicable to both in-circuit and out-of-circuit environments.

Caution

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors, PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of these components contain internal gate protection circuits that are partially effective, but good practice dictates careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

a. Deenergize or disconnect all power and signal sources and loads used with the unit.
b. Place the unit on grounded conductive work surfaces.
c. Ground the repair operator through a conductive wrist strap or other device using a 1-MΩ series resistor to protect the operator.
d. Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

Table 5-1. Tools Required.

DESCRIPTION	CHARACTERISTIC	FUNCTION
20-watt soldering iron	Any	Remove/replace IC's and components.
Solder sucker	Any	Used to remove solder.
Needle-nosed pliers	Any	Bend component leads.
Cutting tools	Various, small diagonal cutter, end nippers, etc (sharp tools that will not leave a burr)	Cut IC and component leads.
Adjustment tool	JFD 5284 or equivalent	Used to adjust variable resistors.
Screwdrivers	Any	Disassembly.

e. All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.
f. When these devices and assemblies are removed from the unit, they should be placed on the conductive work surface or in conductive containers.
g. When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.
h. Do not handle these devices unnecessarily or remove from their packages until actually used or tested.

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

5.2.2 Replacement of Conventional IC's

Integrated circuits (IC's) are delicate items and should not be replaced until all other defects are eliminated and it is determined that the IC is definitely defective.

Note the orientation of the IC on the board before removal to assure correct placement of the new part. Remove the old IC by clipping each lead on the IC using a small diagonal cutter. Heat the leads with a soldering iron and pull them from the board with needle-nose pliers. Clear excess solder from the holes with a solder sucker. This procedure avoids overheating the circuit board and damaging other components or the board itself.

When soldering the new IC into place, avoid excessive heating. An excessive amount of heat may cause internal damage to the IC, making it inoperable. Excessive heat may also damage the circuit board foil. After soldering, use a toothpick to remove any heavy rosin deposits. Solder joints should be smooth, bright, and clean.

5.3 DISASSEMBLY/ASSEMBLY

Warning

This electronic equipment may have components that contain sealed materials (such as beryllium oxide, acids, lithium, radioactive material, mercury, etc) that can be hazardous to your health. If the component enclosure seal is broken, precautions must be taken against personal contact or inhalation, in accordance with OSHA requirements 29CFR 1910.1000, during equipment maintenance, disassembly, or repair.

5.3 DISASSEMBLY/ASSEMBLY

The GLS-350 Glideslope Receiver is a remote mounted unit contained in a 25.4-mm (1.0-in) by 127-mm (5-in) by 273.94-mm (10.785-in) case. The GLS-350E Glideslope Receiver is identical in construction to the GLS-350 with the exception of a filter assembly attached to the front of the unit. This assembly increases the overall length of the GLS-350E to 345.44 mm (13.60 in). Electrical connections are made through one 25-pin connector and an antenna connector located on the front of the chassis. A mounting tray, provided with the GLS-350/350E, permits mounting in any attitude, on any flat surface in the aircraft.

The GLS-350/350E is designed to provide direct access to all parts; removal of the protective outer cover exposes both sides of the printed circuit board, simplifying component replacement procedures.

The simplicity of the GLS-350/350E eliminates the need for detailed disassembly/assembly procedures. However, before attempting to disassemble the unit, the exploded views illustrated in figures 5-1 and 5-2 should be studied carefully.

5.4 TEST EQUIPMENT

Table 5-2 lists the test equipment required for preliminary testing, detailed performance testing, and alignment procedures of the GLS-350/350E Glideslope Receiver. Specifications must be met to ensure proper results.

5.5 TEST AND ALIGNMENT PROCEDURES

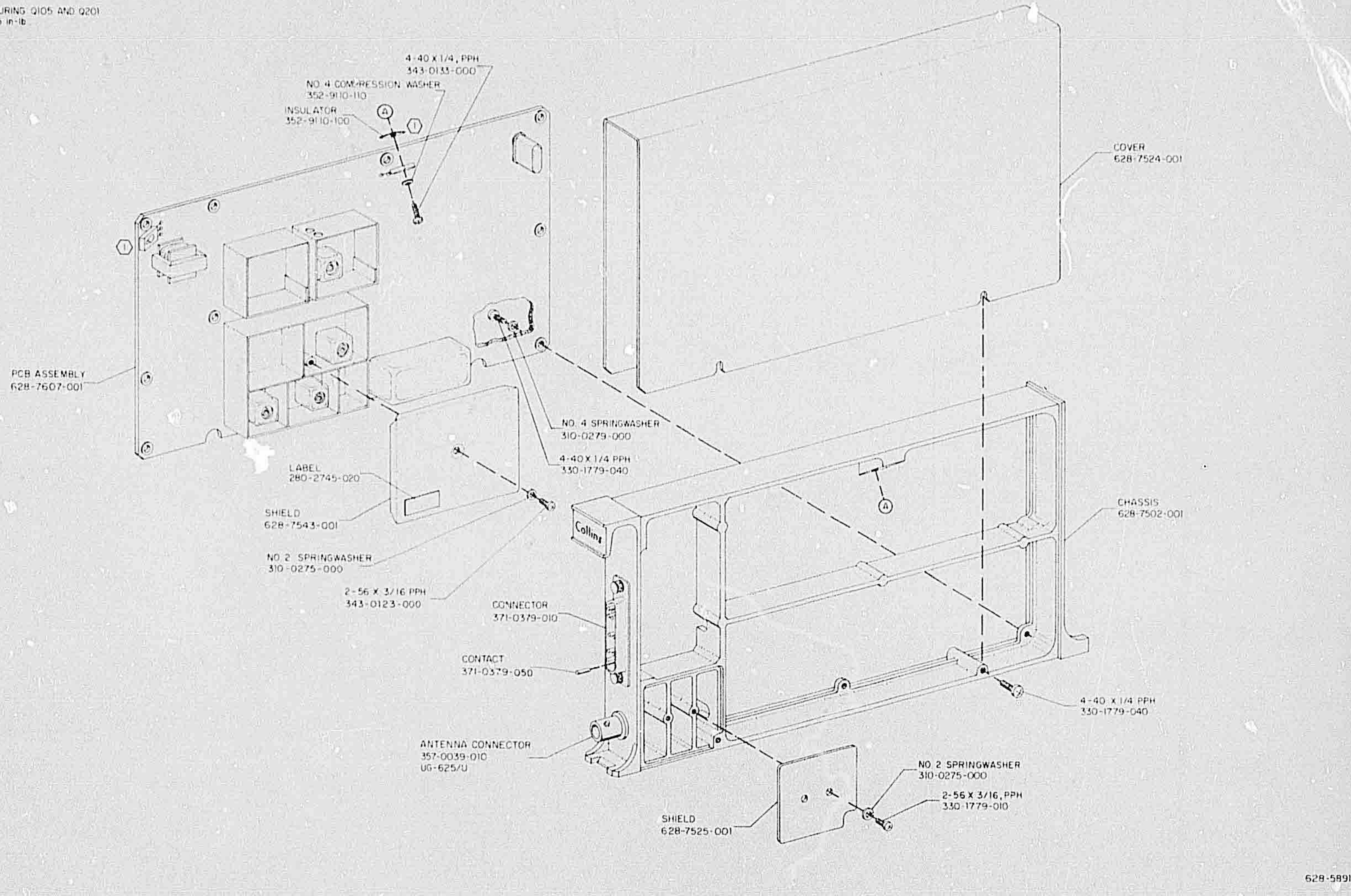
Tables 5-3 and 5-4 are included in this section for the convenience of the technician. Table 5-3 lists the glideslope-localizer frequency pairings for all 40 ILS frequencies. Table 5-4 correlates -dB mW values to microvolts.

Table 5-2. Test Equipment Required.

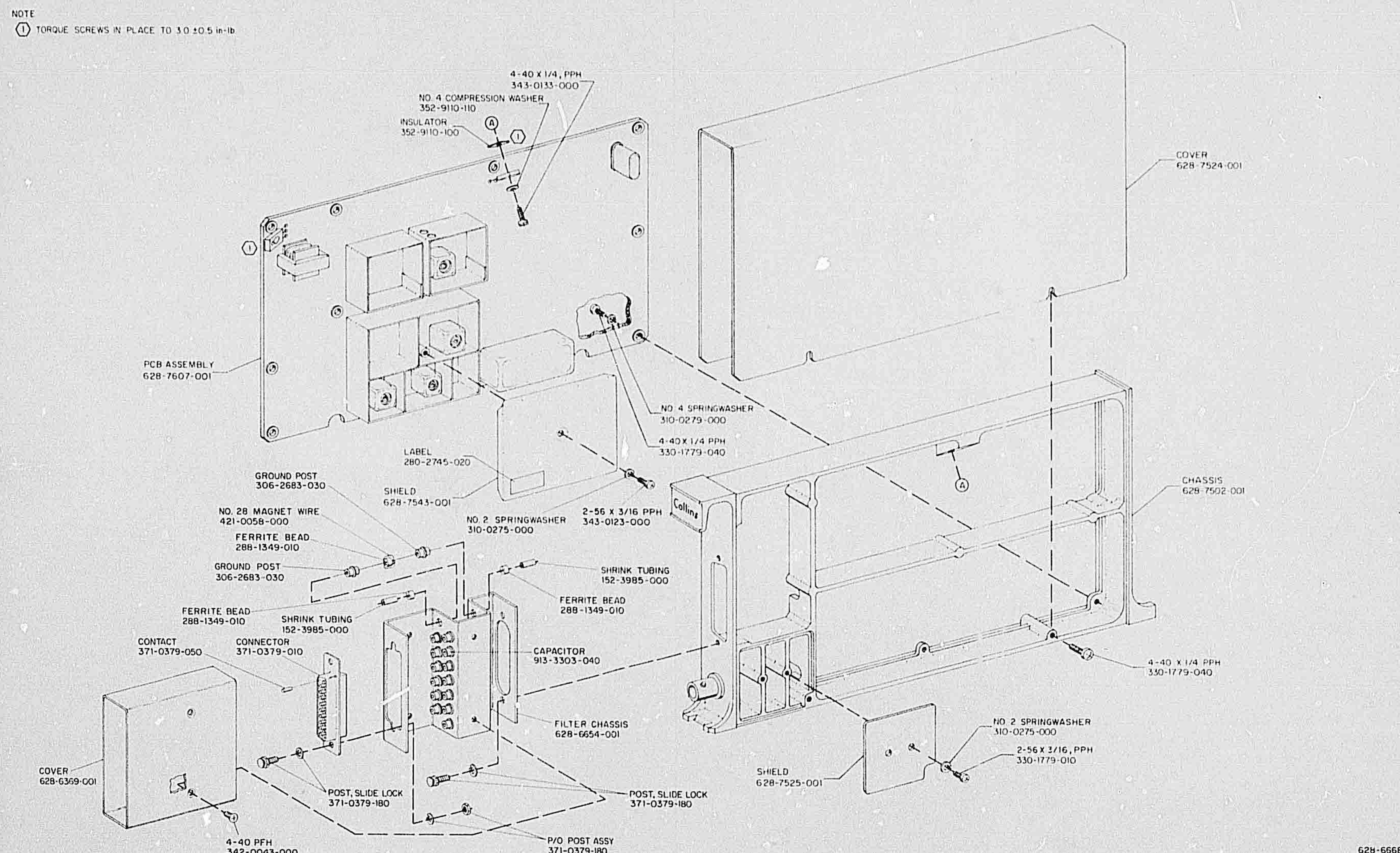
EQUIPMENT	CHARACTERISTIC REQUIRED
Dc power supply	0 to 15 V dc, 1.0 ampere
Glideslope signal generator	Frequency range: 329 to 335 MHz
	Rf output range: 2 μV to 0.2 V
	Rf signal must be capable of being modulated by 90 Hz at 40 ±2.4 percent and 150 at 40 ±2.4 percent simultaneously.
Deviation indicator	Zero center
	±150 μA or mV with 1000 ohms internal resistance.
Flag indicator	500 μA or mV with 1000 ohms internal resistance
Digital voltmeter (dvm)	Input impedance: 1 megohm minimum shunted by a capacitance not to exceed 200 pF
Frequency counter	Range: 100 to 140 MHz
	Accuracy: 0.002 percent of displayed frequency
Attenuator pad, 6 dB	Attenuation: 6 dB
	Impedance: 50 ohms
Oscilloscope	Any dc coupled (used for observation only)

NOTE

(1) TORQUE SCREWS SECURING Q105 AND Q201 IN PLACE TO 3.0 ±0.5 in-lb



GLS-350 Glideslope Receiver, Exploded View
Figure 5-1



GLS-350E Glideslope Receiver, Exploded View
Figure 5-2

Table 5-3. Localizer Glideslope Frequency Pairings.

LOCALIZER FREQUENCY (MHz)	GLIDESLOPE FREQUENCY (MHz)	LOCALIZER FREQUENCY (MHz)	GLIDESLOPE FREQUENCY (MHz)
108.10	334.70	110.10	334.40
108.15	334.55	110.15	334.25
108.30	334.10	110.30	335.00
108.35	333.95	110.35	334.85
108.50	329.90	110.50	329.60
108.55	329.75	110.55	329.45
108.70	330.50	110.70	330.20
108.75	330.35	110.75	330.05
108.90	329.30	110.90	330.80
108.95	329.15	110.95	330.65
109.10	331.40	111.10	331.70
109.15	331.25	111.15	331.55
109.30	332.00	111.30	332.30
109.35	331.85	111.35	332.15
109.50	332.60	111.50	332.90
109.55	332.45	111.55	332.75
109.70	333.20	111.70	333.50
109.75	333.05	111.75	333.35
109.90	333.80	111.90	331.10
109.95	333.65	111.95	330.95

Table 5-4. Conversion of dB mW to Microvolts Across 50 Ohms.

-dB mW	µV	-dB mW	µV	-dB mW	µV	-dB mW	µV	-dB mW	µV	-dB mW	µV
0	224000	21	19900	41	1990	61	199	81	19.9	101	1.99
1	199000	22	17800	42	1780	62	178	82	17.8	102	1.78
2	178000	23	15800	43	1580	63	158	83	15.8	103	1.58
3	158000	24	14100	44	1410	64	141	84	14.1	104	1.41
4	141000	25	12600	45	1260	65	126	85	12.6	105	1.26
5	126000	26	11200	46	1120	66	112	86	11.2	106	1.12
6	112000	27	9990	47	988	67	100	87	9.99	107	0.999
7	99900	28	8900	48	890	68	89.0	88	8.90	108	0.890
8	89000	29	7930	49	793	69	79.3	89	7.93	109	0.793
9	79300	30	7070	50	707	70	70.7	90	7.07	110	0.707
10	70700	31	6300	51	630	71	63.0	91	6.30	111	0.630
11	63000	32	5620	52	562	72	56.2	92	5.62	112	0.562
12	56200	33	5010	53	501	73	50.1	93	5:01	113	0.501
13	50100	34	4460	54	446	74	44.6	94	4.46	114	0.446
14	44600	35	3980	55	398	75	39.8	95	3.98	115	0.398
15	39800	36	3540	56	354	76	35.4	96	3.54	116	0.354
16	35400	37	3160	57	316	77	31.6	97	3.16	117	0.316
17	31600	38	2820	58	282	78	28.2	98	2.82	118	0.282
18	28200	39	2510	59	251	79	25.1	99	2.51	119	0.251
19	25100	40	2240	60	224	80	22.4	100	2.24	120	0.224
20	22400										

If a VIR-351 Navigation Receiver is not available to channel the GLS-350/350E, the frequency control input code shown in figure 5-3 must be used. The test setup of figure 5-3 provides the proper switching network required to channel the receiver.

5.5.1 Test Procedures

Caution

Remove power before connecting or disconnecting the GLS-350/350E to any test fixtures or equipment.

Note

Failure to meet any of the following test results indicates a defective component or an out-of-alignment condition. Refer to paragraph 5.5.2 for alignment procedures.

5.5.1.1 Power Supply

a. Connect receiver to test equipment as illustrated in figure 5-3. Ground ILS control line, and apply +13.75 V dc to P2 pin 2; ground P2 pin 1. Observe current drain. Result: 0.40 to 0.50 A.
b. Connect a dvm to test point TP107 and ground and observe indication. Result: 8.50 to 9.50 Vdc.
c. Connect dvm to TP207 and ground and observe indication. Result: 4.8 to 5.4 Vdc.
d. Reconnect dvm to TP107 and remove ILS control line ground. Result: Less than 1.0 V dc.

5.5.1.2 RF Sensitivity

a. Tune receiver to 329.15 MHz (108.95). Connect deviation meter to P2 pins 9 and 10. Apply a 20-μV (-81 dB) glideslope deviation signal at 329.15 MHz, 90 > 150 (0.091 DDM), and observe deviation meter indication. Result: Deviation greater than 47 mV.
b. Repeat step a for each of the remaining 39 glideslope frequencies. Result: Deviation greater than 47 mV for each frequency.

5.5.1.3 Receiver Selectivity

a. Tune receiver to 329.15 MHz (108.95). Connect dvm to AGC test point TP102 and ground. Apply a glideslope test signal at 329.15 MHz, 22 μV (-80 dB). Record AGC reference voltage.
b. Increase rf input level to 45 μV (-74 dB). Slowly change rf generator frequency until the AGC reference voltage recorded in step a is reached both above and below the 329.15-MHz reference frequency. Results: Upper 6-dB frequency not less than 329.185 MHz, lower 6-dB frequency not greater than 329.115 MHz.

5.5.1.4 Centering

Tune receiver to 335.00 MHz (110.30). Connect deviation meter to P2 pins 9 and 10. Apply a glideslope centering signal at 335.00 MHz, 700 μV (-50 dB). Result: Deviation meter indicates 0 ±3.0 mV.

5.5.1.5 Deviation

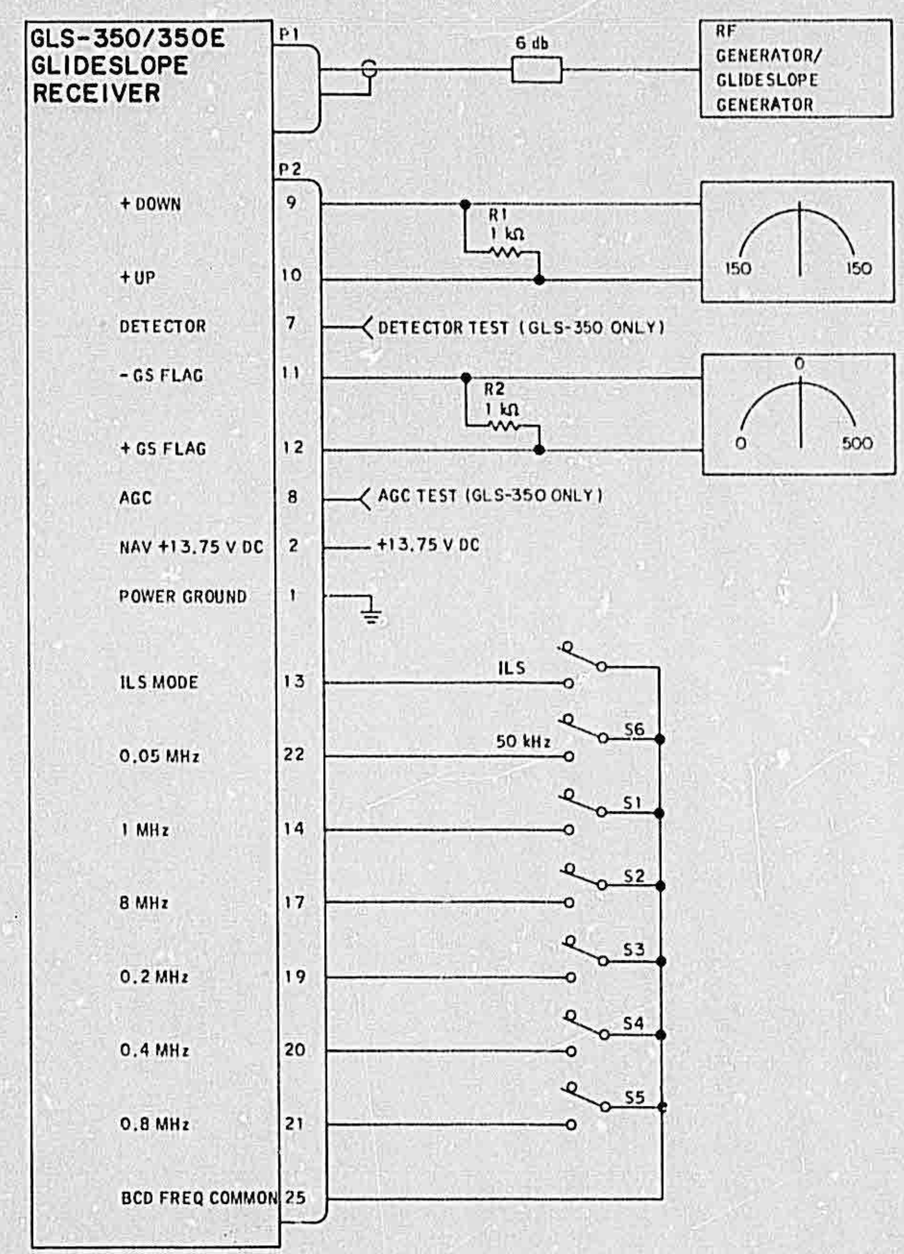
a. Tune receiver to 335.00 MHz (110.30). Connect deviation meter to P2 pins 9 and 10. Apply a glideslope deviation signal at 335.00 MHz, 90 > 150 (0.091 DDM), 700 μV (-50 dB). Observe deviation meter indication. Result: +78 ±6 mV.
b. Apply a glideslope deviation signal at 335.00 MHz, 700 μV (-50 dB), 150 > 90 (0.091 DDM). Observe deviation meter indication. Result: -78 ±6 mV.

5.5.1.6 Deviation Tracking

a. Tune receiver to 332.00 MHz (109.30). Apply a glideslope deviation signal at 332.00 MHz, 150 > 90 (0.091 DDM). Connect deviation meter to P2 pins 9 and 10.
b. Observe deviation meter, and vary generator rf output level between 100 μV (-67 dB) and 10 mV (-27 dB). Result: Deviation meter indicates -78 ±6 mV.
c. Apply a glideslope deviation signal at 332.00 MHz 90 > 150 (0.091 DDM). Vary the rf input from 100 μV (-67 dB) to 10 mV (-27 dB) and observe deviation meter. Result: +78 ±6 mV.
d. Repeat steps a through c using the following DDM levels. Results: 0.175 DDM results in 148 ±10 mV in both directions. 0.045 DDM results in 39 ±3 mV in both directions.

5.5.1.7 GS Flag

a. Tune receiver to 332.00 MHz (109.30). Apply a glideslope test signal at 332.00 MHz, 0-percent modulation. Set rf input level to 1 mV (-47 dB). Connect flag meter to pins 11 and 12 and observe indication. Result: Not greater than 180 mV (flag in view).
b. Set DDM control to 150 Hz only, and adjust for 40-percent modulation. Set rf input level to 700 μV -50 dB). Observe flag meter indication. Result: Not more than 180 mV (flag in view).
c. Set DDM control to 90 Hz only, and adjust for 40-percent modulation. Set rf input level to 700 μV (-50 dB). Observe flag meter indication. Result: Not more than 180 mV (flag in view).



GLIDESLOPE FREQUENCY CONTROL INPUT LEVELS

GLIDESLOPE FREQUENCY MHz	LOCALIZER FREQUENCY MHz	GLIDESLOPE FREQUENCY CONTROL WIRES (DECODER INPUT) 8 (S2)	1 (S1)	0.8 (S5)	0.4 (S4)	0.2 (S3)	0.05 (S6)
329.15	108.95	1	0	1	0	0	1
329.30	108.90	1	0	1	0	0	0
329.45	110.55	0	0	0	1	0	1
329.60	110.50	0	0	0	1	0	0
329.75	108.55	1	0	0	1	0	1
329.90	108.50	1	0	0	1	0	0
330.05	110.75	0	0	0	1	1	1
330.20	110.70	0	0	0	1	1	0
330.35	108.75	1	0	0	1	1	1
330.50	108.70	1	0	0	1	1	0
330.65	110.95	0	0	1	0	0	1
330.80	110.90	0	0	1	0	0	0
330.95	111.95	0	1	1	0	0	1
331.10	111.90	0	1	1	0	0	0
331.25	109.15	1	1	0	0	0	1
331.40	109.10	1	1	0	0	0	0
331.55	111.15	0	1	0	0	0	1
331.70	111.10	0	1	0	0	0	0
331.85	109.35	1	1	0	0	1	1
332.00	109.30	1	1	0	0	1	0
332.15	111.35	0	1	0	0	1	1
332.30	111.30	0	1	0	0	1	0
332.45	109.55	1	1	0	1	0	1
332.60	109.50	1	1	0	1	0	0
332.75	111.55	0	1	0	1	0	1
332.90	111.50	0	1	0	1	0	0
333.05	109.75	1	1	0	1	1	1
333.20	109.70	1	1	0	1	1	0
333.35	111.75	0	1	0	1	1	1
333.50	111.70	0	1	0	1	1	0
333.65	109.95	1	1	1	0	0	1
333.80	109.90	1	1	1	0	0	0
333.95	108.35	1	0	0	0	1	1
334.10	108.30	1	0	0	0	1	0
334.25	110.15	0	0	0	0	0	1
334.40	110.10	0	0	0	0	0	0
334.55	108.15	1	0	0	0	0	1
334.70	108.10	1	0	0	0	0	0
334.85	110.35	0	0	0	0	1	1
335.00	110.30	0	0	0	0	1	0

628-5879
TP4-3259-014

Bench Test Setup
Figure 5-3

d. Set DDM control to 0.091 DDM (90 > 150). Adjust rf input level to obtain a 39-mV indication on the deviation meter. Observe flag meter indication. Result: Not more than 180 mV (flag in view).
e. Set DDM control to 0. Observe flag meter indication at rf levels of 20 μV (-81 dB) and 30 mV (-17 dB). Result: Greater than 250 mV (flag out of view).

5.5.2 Alignment Procedures

5.5.2.1 Synthesizer Alignment

5.5.2.1.1 Second Injection

Connect rf voltmeter to gate 2 of MOSFET Q103 and adjust L115 for maximum rf voltage (approximately 1 V ms). Rotate L115 slug 3/4 turn or until 0.1-V rms drop is observed (do not exceed 3/4 turn).

Note

The specified voltage may be obtained by rotating the slug in either direction. Use the direction in which voltage changes are more gradual when slug is rotated.

5.5.2.1.2 Loop Injection

a. Tune receiver to 332.00 MHz (109.30). Connect oscilloscope to test point TP206 and observe indication. Result: Greater than 3.0 V p-p. If necessary, adjust C168 until result is obtained.
b. Tune the receiver to 335.00 MHz (110.30) and 329.15 MHz (108.95), and observe scope indication for each frequency. Result: Greater than 3.0 V p-p.

5.5.2.1.3 VCO Tuning Voltage

Tune receiver to 329.15 MHz (108.95). Connect dvm to test point TP205 and observe indication. Result: 3.00 ±0.5 V dc. If necessary, adjust C213 and L203 until result is obtained.

5.5.2.1.4 First Injection

a. Tune receiver to 332.00 MHz (109.30). Connect rf voltmeter to gate 2 of MOSFET Q101.
b. Adjust C162 and C164 for a maximum indication on rf voltmeter. Record maximum indication for reference.
c. Tune receiver to 335.00 MHz (110.30) and record indication observed on rf voltmeter. Tune receiver to 329.15 MHz (108.95) and record indication observed at that frequency.
d. Compare voltages of step c with the reference voltage recorded in step b. Results: Voltages of step c must be within 2 dB of reference level.

5.5.2.2 Receiver Alignment

5.5.2.2.1 Preselector and IF

a. Tune receiver to 332.00 MHz (109.30). Connect dvm to AGC test point TP102 and ground. Apply a glideslope test signal at 332.00-MHz, 0 μV.
b. Increase rf input level until voltage present at test point TP102 is increased by 0.1 V dc.
c. Adjust C103, C104, C105, L105, L106, L107, and L108 for maximum AGC voltage at TP102 while simultaneously reducing generator output level to maintain the 0.1-V dc increase over static AGC level.
d. After initial tuning, repeat step c again adjusting for maximum AGC.

5.5.2.2.2 AGC Adjustment

a. Tune receiver to 332.00 MHz (109.30). Apply a glideslope test signal at 332.00 MHz, 0.5 mV. Connect ac voltmeter to test point TP103.
b. Adjust R127 to provide less than 1-dB variation when rf input level is varied from 50 mV (-13 dB) to 100 μV (-67 dB).

5.5.2.2.3 Low-Pass Filter Alignment

a. Tune receiver to 332.00 MHz (109.30). Apply a glideslope test signal at 332.15 MHz, 22 mV (-20 dB). Connect dvm to test point TP102.
b. Adjust L201 and L202 for minimum AGC at TP102. If necessary, increase rf input level to permit adjustment.
c. Apply a glideslope test signal at 332.00 MHz (109.3) 70 μV (-70 dB) and record AGC reference voltage at TP102.
d. Apply glideslope test signals at 332.15 MHz (111.35) and 331.7 MHz (111.10). For each test signal, vary rf input level until reference voltage recorded in step c is obtained. Observe difference in rf input levels for each frequency. Results: difference in levels 60 dB minimum.

Note

Slug of L202 may be bottomed.

5.5.2.3 Instrumentation Alignment

5.5.2.3.1 Deviation Centering

a. Tune receiver to 332.00 MHz (109.30). Apply a glideslope centering signal at 332.00 MHz, 700 μV. Connect deviation meter to P2 pins 9 and 10.
b. Adjust R133 for center deflection of 0 ±0.5 mV (tones balanced).

5.5.2.3.2 Deviation Deflection

a. Tune receiver to 332.00 MHz (109.30). Apply a glideslope deviation signal at 332.00 MHz, 90 > 150 (0.091 DDM), 700 μV. Connect deviation meter to P2 pins 9 and 10.
b. Adjust R131 for +78 ±1-mV deflection.
c. Apply a glideslope deviation signal at 332.00 MHz, 150 > 90 (0.091 DDM), 700 μV.
d. Check for -78 ±1-mV deflection. Slight readjustments of R131 may be necessary.
e. Repeat alignment procedures of paragraphs 5.5.2.3.1 and 5.5.2.3.2 until all requirements are satisfied.

Collins GLS-350/350E Glideslope Receiver

Rockwell International

diagrams

Collins General Aviation Division

Printed in USA

523-0766027-005118
5th Edition, 9 June 1982

list of illustrations

NOTICE: This section replaces fourth edition dated 1 June 1978.

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	14 Feb 75		None				
2nd Ed	1 Sep 75		GLS-350 SB 1				
3rd Ed	15 Jun 76		GLS-350 SB 1				
4th Ed	1 Jun 78		GLS-350; SB 1, SIL 1-76; GLS-350E; SIL 1-76				
5th Ed	9 Jun 82		GLS-350: SB 1, 2, SIL 1-76; GLS-350E: SB 1, SIL 1-76				

section VI

diagrams

6.1 CONFIGURATION STATUS CONTROL

Collins Radio Group of Rockwell International uses the following method for identifying the configuration status of a unit or subassembly.

A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — if no changes have been processed. The first change will be identified as A, the second as B, and continuing through Z to AA, AB, and ultimately to ZZ. Incorporation of design changes in a unit or subassembly that has been returned to Collins for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F and unit two is marked REV F. This indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

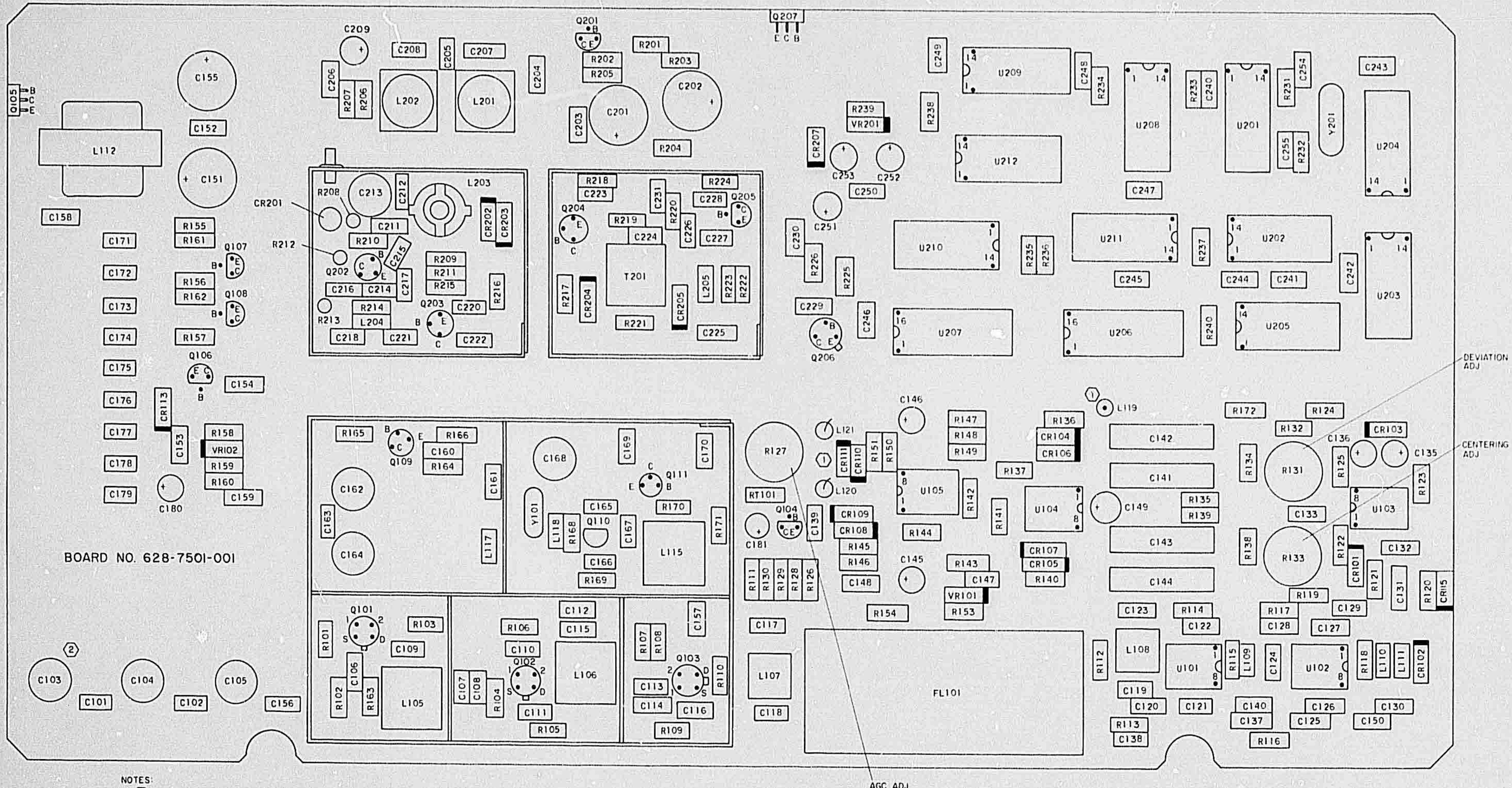
A reworked unit may not contain all design changes made to the reworked identifier, but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may physically appear different from a newly manufactured unit with the same alphabetic identifier.

Only alphabetic identifiers that result in schematic changes are covered in this section. If a unit or subassembly has an identifier that alphabetically falls between identifiers on the schematic changes page, or after the last identifier on the schematic changes page up to and including the latest effectivity listed below, the electrical configuration is represented by the earlier identifier listed on the schematic changes page.

6.2 SCHEMATIC DIAGRAMS

The GLS-350/350E Glideslope Receiver component location diagrams and schematic diagrams are provided in figures 6-1 through 6-3.

A schematic changes sheet precedes each schematic The change sheet provides a description of schematic changes, a reason for the changes, the service bulletin number (if applicable) that modifies the unit, and the production cut-in effectivity for the change.



NOTES:

① INDUCTORS L119, 120, 121 EFFECTIVE REVISION G AND SERVICE BULLETIN NO 1.

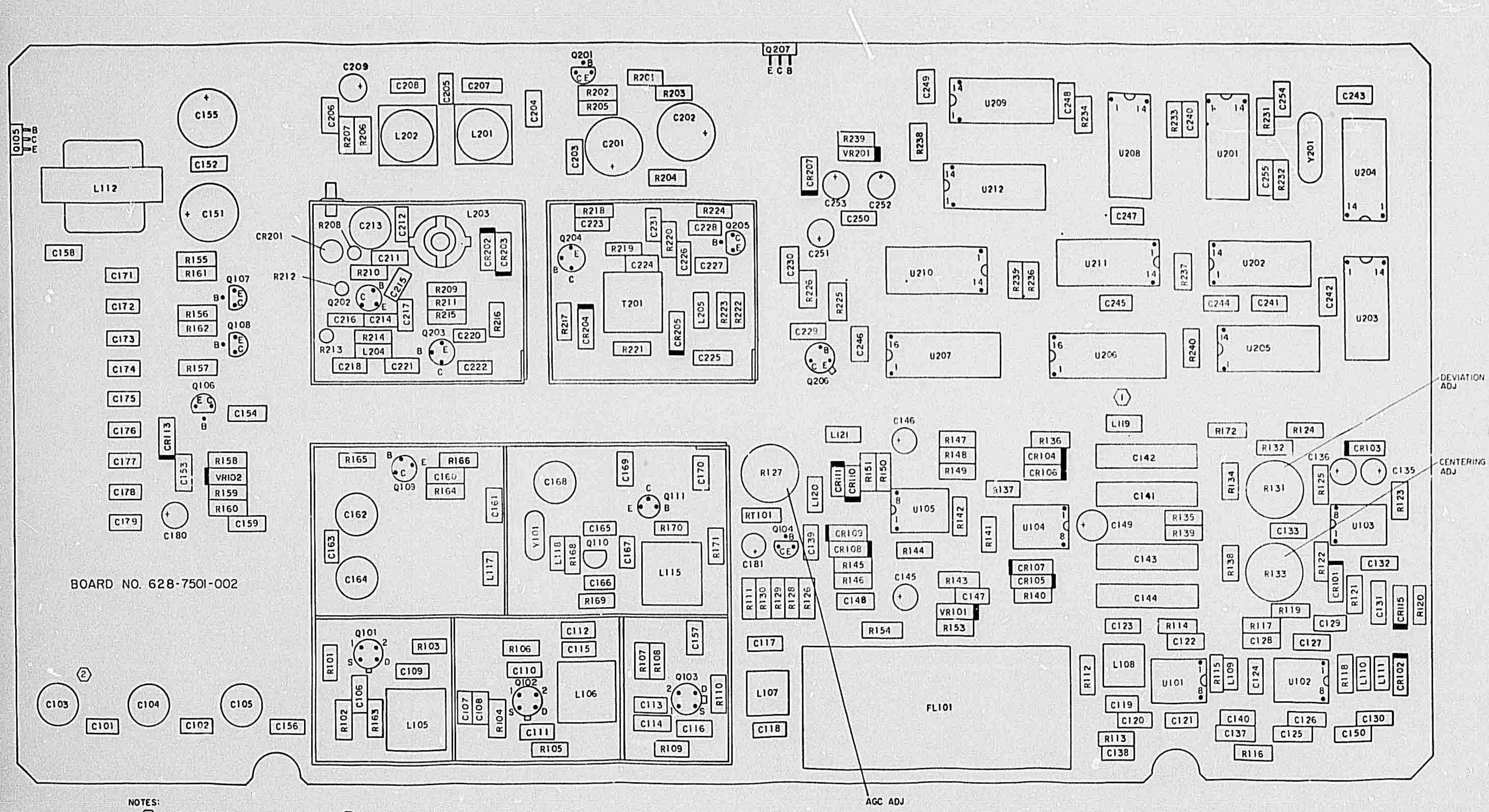
② GLS - 350E ONLY

ROTOR LEAD — C103 — UNUSED HOLE

STATOR LEAD

628-5653

GLS-350/350E Glideslope Receiver, Board No 628-7501-001, Component Location Diagram
Figure 6-1

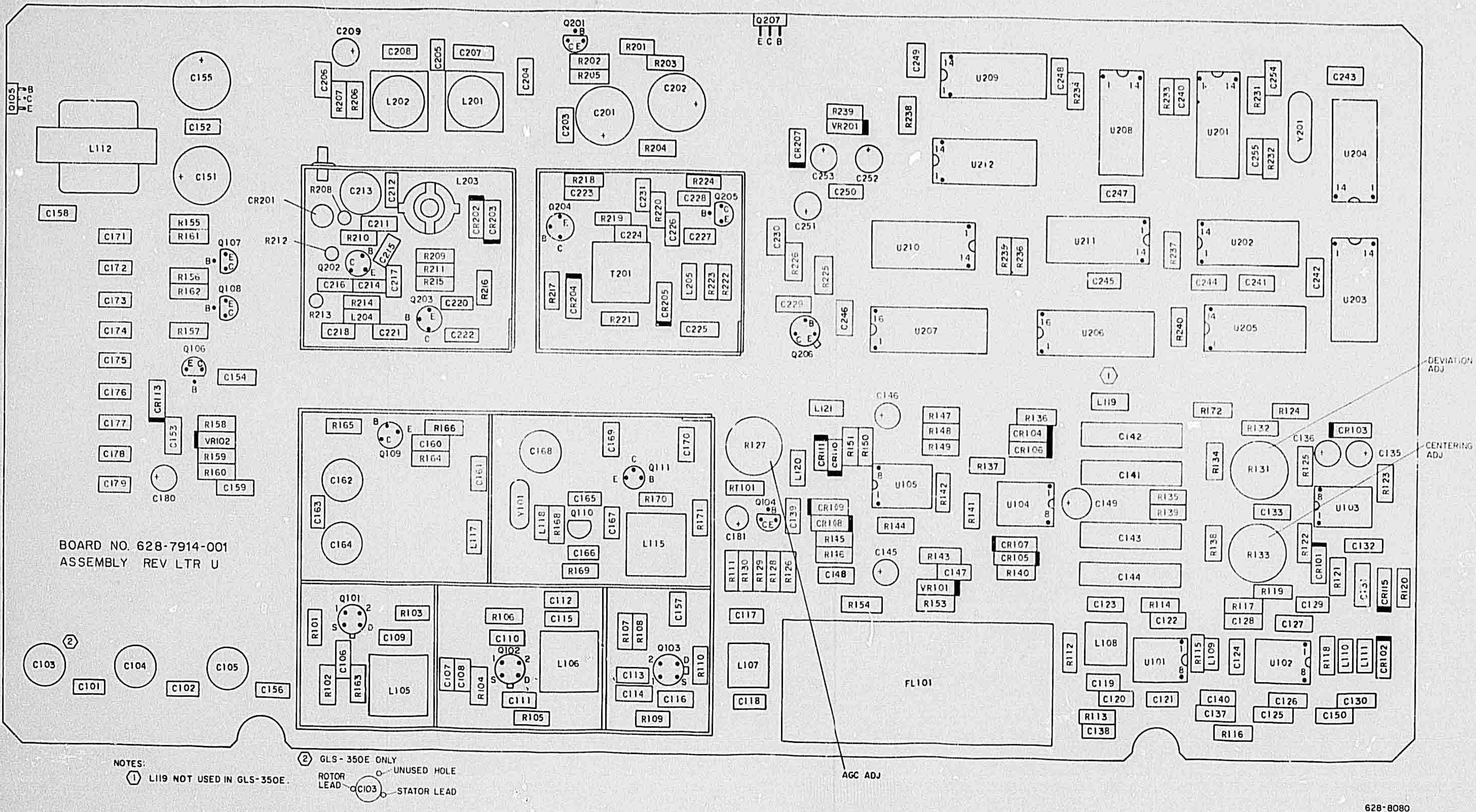


NOTES:
(1) L119 NOT USED IN GLS-350E.
(2) GLS-350E ONLY

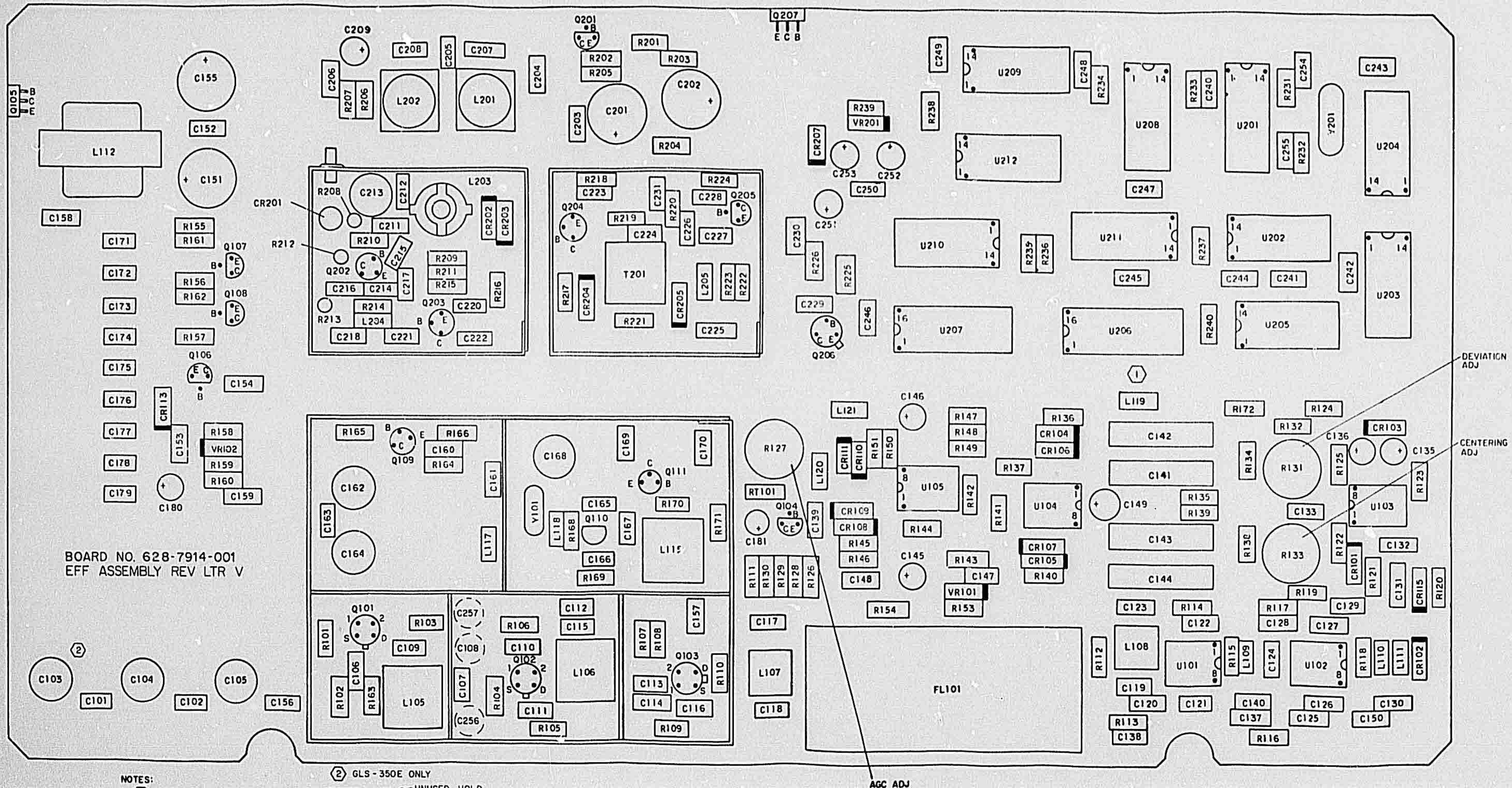
ROTOR LEAD — C103 — UNUSED HOLE
STATOR LEAD

628-8073

GLS-350/350E Glideslope Receiver, Board No 628-7501-002, Component Location Diagram
Figure 6-1A



GLS-350/350E Glideslope Receiver, Board No 628-7914-001, Effective Assembly Revision U, Component Location Diagram
Figure 6-1B



NOTES:
(1) L119 NOT USED IN GLS-350E.
(2) GLS-350E ONLY

ROTOR LEAD (C103) UNUSED HOLD STATOR LEAD

628-8167

GLS-350/350E Glideslope Receiver, Board No 628-7914-001, Effective Assembly Revision V, Component Location Diagram
Figure 6-1C

 Revised 9 June 1982

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
2	Added L119, L120, and L121 to reduce susceptibility to vhf transceiver interference.	SB 1	REV G (GLS-350)
3	Added GLS-350E filter components and notes 6 and 7.	NA	GLS-350E
4	Changed Q103 from 3SK35-Y to 40841 and Q102 from 40673 to 40841 to standardize components.	NA	REV L (GLS-350/350E)
5	Changed CR115 from 1N4454 to 1N4156, R119 from 4.7 kΩ to 5620Ω, R124 from 3.3 kΩ to 3320Ω, R125 from 5.6 kΩ to 5620Ω, and R132 from 2.2 kΩ to 2210Ω to minimize flag voltage change at low temperatures.	NA	REV M (GLS-350/350E)
F	Added C256 and C257 to prevent instability in first if amplifier.	NA	REV V (GLS-350/350E)

GLS-350/350E Receiver/Instrumentation, Schematic Diagram
Figure 6-2 (Sheet A)

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
C1- C100	NOT USED	
C101	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1PF, ±0.25 PF, 50V	913-3308-020
C102	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1PF, ±25PF, 50V	913-3308-020
C103	CAPACITOR, VARIABLE, CERAMIC, 5/20PF, 200V	917-1260-010
C104	CAPACITOR, VARIABLE, CERAMIC, 5/20PF, 200V	917-1260-010
C105	CAPACITOR, VARIABLE, CERAMIC, 5/20PF, 200V	917-1260-010
C106	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C107	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 33PF, ±5%, 50V	913-3308-160
C108	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 33PF, ±5%, 50V	913-3308-160
C109	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C110	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C111	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C112	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C113	CAPACITOR, FIXED, SILVERED MICA, 22 PF, ±5%, 50V (EFF REV C)	912-2099-140
C113	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22PF, ±5%, 50V	913-3308-140
C114	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 100PF, ±5%, 50V	913-3308-220
C115	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C116	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C117	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C118	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
*C119	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
*C119 or	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 5PF, ±0.25PF, 50V	913-3308-050
*C119 or	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 5PF, ±0.5PF, 50V	913-3308-060
*C119	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 5PF, ±0.5PF, 50V	913-3308-070
*C119	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 6PF, ±0.5PF, 50V	913-3308-080
*C119	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 7PF, ±0.5PF, 50V	913-3308-090

*FACTORY TEST SELECT - REPLACE WITH SAME VALUE

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
*C119	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 9PF, ±0.5PF, 50V	913-3308-100
*C119	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C120	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C121	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C122	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, ±20%, 50V (EFF REV C)	913-3306-040
C122	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3298-130
C123	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, ±20% 50V (EFF REV C)	913-3306-040
C123	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3298-130
C124	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C125	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C126	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C127	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, ±20%, 50V (EFF REV C)	913-3306-040
C127	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3298-130
C128	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, ±20%, 50V (EFF REV C)	913-3306-040
C128	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3298-130
C129	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C130	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C131	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 0.047UF, ±10PF, 50V	933-1409-070
C132	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, ±20%, 50V (EFF REV C)	913-3306-040
C132	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3298-130
C133	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C134	NOT USED	
C135	CAPACITOR, FIXED, TANTALUM, 4.7UF, ±20%, 20V	184-9113-060
C136	CAPACITOR, FIXED, TANTALUM, 4.7UF, ±20%, 20V	184-9113-060
C137	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010

*FACTORY TEST SELECT - REPLACE WITH SAME VALUE

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
C138	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C139	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C140	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
*C141	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 0.18UF, ±2%, 50V	933-1403-070
*C142	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 0.18UF, ±2%, 50V	933-1403-070
*C143	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 0.1UF, ±2%, 50V	933-1403-060
*C144	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 0.1UF, ±2%, 50V	933-1403-060
C145	CAPACITOR, FIXED, TANTALUM, 22UF, ±10%, 15V (EFF REV C) (EFF REV J)	184-9113-250
C145	CAPACITOR, FIXED, TANTALUM, 22UF, ±20%, 15V	184-9113-080
C146	CAPACITOR, FIXED, TANTALUM, 22UF, ±10%, 15V (EFF REV C) (EFF REV J)	184-9113-250
C146	CAPACITOR, FIXED, TANTALUM, 22UF, ±20%, 15V	184-9113-080
C147	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C148	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C149	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, +100-20%, 16V	183-1471-150
C150	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 62PF, ±5%, 50V	913-3308-190
C151	CAPACITOR, FIXED, ELECTROLYTIC, 47UF, +100-20%, 35V	183-1471-190
C152	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C153	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C154	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 47,000PF, ±10PF, 50V	933-1409-070
C155	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, +100-20%, 16V	183-1471-090
C156	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 12PF, ±5%, 50V	913-3308-120
C157	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 2PF, ±0.25PF, 50V	913-3308-030
C158	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C159	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010

*REPLACEMENT MUST BE IDENTICAL TO ORIGINAL COMPONENTS.

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
C160	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C161	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C162	CAPACITOR, VARIABLE, CERAMIC, 5/20PF, 200V	917-1260-010
C163	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 50V	913-3308-040
C164	CAPACITOR, VARIABLE, CERAMIC, 5/20PF, 200V	917-1260-010
C165	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1PF, ±0.25PF, 50V	913-3308-020
C166	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C167	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 15PF, ±5%, 50V	913-3308-130
C168	CAPACITOR, VARIABLE, CERAMIC, 5/20PF, 200V	916-1260-010
C169	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 5PF, ±0.25PF, 50V	913-3308-050
C170	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C171	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C172	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C173	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C174	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C175	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C176	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C177	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C178	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C179	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C180	CAPACITOR, FIXED, ELECTROLYTIC, 3.3UF, +100-20%, 25V	183-1471-160
C181	CAPACITOR, FIXED, ELECTROLYTIC, 10UF, +100-20%, 25V	183-1471-140
C182-C200	NOT USED	
C201	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, +100-20%, 16V	183-1471-090
C202	CAPACITOR, FIXED, ELECTROLYTIC, 100UF, +100-20%, 16V	183-1471-090
C203	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C204	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 2200PF, ±10PF, 50V	933-1409-030

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
C205	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 3300PF, ±5%, 50V	933-1409-040
C206	CAPACITOR, FIXED, CERAMIC, 1000PF, ±10PF, 50V	933-1409-010
C207	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 68PF, ±5%, 50V	913-3308-200
C208	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 33PF, ±5%, 50V	913-3308-160
C209	CAPACITOR, FIXED, TANTALUM, 1UF, ±20%, 35V	184-9113-030
C210	CAPACITOR, FEEDTHROUGH, 1000PF, +100-20%, 50V	913-3303-040
C211	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22PF, ±5%, 50V	913-3308-170
C212	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 15PF, ±5%, 50V	913-3308-150
C213	CAPACITOR, VARIABLE, CERAMIC, 4/13PF, 200V	917-1260-020
C214	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 7PF, ±0.5PF, 50V	913-3308-090
C215	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 5PF, ±0.5PF, 50V	913-3308-070
C216	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C217	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 2PF, ±0.25PF, 50V	913-3308-030
C218	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C219	CAPACITOR, FEEDTHROUGH, 1000PF, +100-20%, 50V	913-3303-040
C220	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C221	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 10PF, ±0.5PF, 50V	913-3308-110
C222	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 8PF, ±0.5PF, 50V	913-3308-240
C223	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C224	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF, ±10%, 50V	913-3312-010
C225	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 47PF, ±5%, 50V	913-3308-180
C226	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 33PF, ±5%, 50V	913-3308-160
C227	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C228	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C229	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C230	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C231	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C232-C239	NOT USED	

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
C240	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C241	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C242	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C243	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C244	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C245	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C246	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C247	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C248	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C249	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C250	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF, +80-20%, 50V	913-3311-010
C251	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, +100-20%, 35V	183-1471-150
C252	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, +100-20%, 16V	183-1471-150
C253	CAPACITOR, FIXED, ELECTROLYTIC, 22UF, +100-20%, 16V	183-1471-150
C254	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 47PF, ±5%, 50V	913-3308-180
C255	CAPACITOR, FIXED, PLASTIC DIELECTRIC, 2200PF, ±10%, 50V	933-1409-030
C256	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 100PF, 5%, 50V (EFF REV V)	913-3308-220
C257	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 5PF ±1/2PF, 50V (EFF REV V)	913-3308-020
C258-C299	NOT USED	
C300	CAPACITOR, FEED-THRU, 1000 PF +100, -20% 50V (GLS-350E ONLY)	913-3303-010
C351	CAPACITOR, FEED-THRU, 1000 PF +100, -20% 50V (GLS-350E ONLY)	913-3303-010
CR1-CR100	NOT USED	
CR101	DIODE, 1S1588	353-0450-010
CR102	DIODE, 1S1588	353-0450-010
CR103	DIODE, 1S1588	353-0450-010
CR104	DIODE, 1S1588	353-0450-010
CR105	DIODE, 1S1588	353-0450-010
CR106	DIODE, 1S1588	353-0450-010
CR107	DIODE, 1S1588	353-0450-010

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
CR108	DIODE, 1S1588	353-0450-010
CR109	DIODE, 1S1588	353-0450-010
CR110	DIODE, 1S1588	353-0450-010
CR111	DIODE, 1S1588	353-0450-010
CR112	NOT USED	
CR113	DIODE, 1S1588	353-0450-010
CR114	NOT USED	
CR115	DIODE, 1N4156 (EFF REV M)	353-3743-010
CR115	DIODE, 1N4454	353-3741-010
CR116- CR200	NOT USED	
CR201	DIODE, MV2105	353-0446-010
CR202	DIODE, 1S1588	353-0450-010
CR203	DIODE, 1S1588	353-0450-010
CR204	DIODE, 1S2187	353-0451-010
CR205	DIODE, 1S2187	353-0451-010
CR206	NOT USED	
CR207	DIODE, 1S1588	353-0450-010
FL1- FL100	NOT USED	
FL101	FILTER, BANDPASS, CRYSTAL, 10.7 MHZ	293-1286-010
L1- L100	NOT USED	
L101	COIL, P/O PRINTED CIRCUIT BOARD	
L102	COIL, P/O PRINTED CIRCUIT BOARD	
L103	COIL, P/O PRINTED CIRCUIT BOARD	
L104	NOT USED	
L105	COIL, 70 MHZ	278-0420-040
L106	COIL, 70 MHZ	278-0420-040
L107	COIL, 10.7 MHZ	278-0419-010
L108	COIL, 10.7 MHZ	278-0419-010
L109	COIL, 3.3UH	240-2742-160
L110	COIL, 3.3UH	240-2742-160
L111	COIL, 100UH	240-2742-170
L112	COIL, 125UH	668-0262-020
L113	COIL, P/O PRINTED CIRCUIT BOARD	
L114	COIL, P/O PRINTED CIRCUIT BOARD	
L115	COIL	278-0420-030
L116	COIL, P/O PRINTED CIRCUIT BOARD	
L117	COIL, 0.68UH	240-2742-020
L118	COIL, 0.56UH	240-2742-230
L119	COIL, 1.2UH (EFF REV G, SB NO 1; NOT USED IN GLS-350E)	240-2742-190
L120	COIL, 1.2UH (EFF REV G, SB NO 1)	240-2742-190
L121	COIL, 1.2UH (EFF REV G, SB NO 1)	240-2742-190
L122- L200	NOT USED	
L201	COIL, 11.75MH	278-0421-010
L202	COIL, 7MH	278-0421-020
L203	COIL, RESONANT AT 100 MHZ, VARIABLE	278-0425-010

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
L204	COIL, 0.15UH	240-2742-100
L205	COIL, 0.82UH	240-2742-220
L206-L299	NOT USED	
L300	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L301	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L302	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L303	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L304	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L305	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L306	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L307	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L308	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L309	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L310	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L311	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L312	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L313	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L314	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L315	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L316	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L317	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L318	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L319	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L320	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L321	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L322	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L323	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L324	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L325	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L326	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L327	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L328	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L329	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L330	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L331	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L332	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L333	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L334	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L335	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L336	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L337	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L338	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L339	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
L340	FERRITE BEAD (GLS-350E ONLY)	288-1349-010
Q1-Q100	NOT USED	
Q101	TRANSISTOR, 3N212	352-5016-010
Q102	TRANSISTOR, 40841 (EFF REV L)	352-5005-010
Q102	TRANSISTOR, 40673	352-5045-010

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
Q103	TRANSISTOR, 40841 (EFF REV L)	352-5005-010
Q103	TRANSISTOR, 3SK35-Y	352-5042-010
Q104	TRANSISTOR, JA1350G	352-5039-010
Q105	TRANSISTOR, MJE-800	352-5028-010
Q106	TRANSISTOR, JA1350G	352-5039-010
Q107	TRANSISTOR, JA1050G	352-5039-020
Q108	TRANSISTOR, JA1050G	352-5039-020
Q109	TRANSISTOR, 2N3563	352-5020-010
Q110	TRANSISTOR, 2SK19-GR	352-5040-010
Q111	TRANSISTOR, 2N3563	352-5020-010
Q112-Q200	NOT USED	
Q201	TRANSISTOR, JA1350G	352-5039-010
Q202	TRANSISTOR, 2N5179	352-5050-010
Q203	TRANSISTOR, 2N3563	352-5020-010
Q204	TRANSISTOR, 2N3563	352-5020-010
Q205	TRANSISTOR, JA1050G	352-5039-020
Q206	TRANSISTOR, 2N2369	352-5015-010
Q207	TRANSISTOR, JA7152	352-5038-010
R1-R100	NOT USED	
R101	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R102	RESISTOR, FIXED, COMPOSITION, 150 OHMS, ±5%, 1/4W	745-7958-050
R103	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R104	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R105	RESISTOR, FIXED, COMPOSITION, 150 OHMS, ±5%, 1/4W	745-7958-050
R106	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R107	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R108	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R109	RESISTOR, FIXED, COMPOSITION, 150 OHMS, ±5%, 1/4W	745-7958-050
R110	RESISTOR, FIXED, COMPOSITION, 2.7K, ±5%, 1/4W	745-7958-220
R111	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R112	RESISTOR, FIXED, COMPOSITION, 2.2K, ±5%, 1/4W	745-7958-210
R113	RESISTOR, FIXED, COMPOSITION, 5.6K, ±5%, 1/4W	745-7958-260
R114	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±5%, 1/4W	745-7958-070
R115	RESISTOR, FIXED, COMPOSITION, 2.7K, ±5%, 1/4W	745-7958-220
R116	RESISTOR, FIXED, COMPOSITION, 5.6K, ±5%, 1/4W	745-7958-260
R117	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R118	RESISTOR, FIXED, COMPOSITION, 2.7K, ±5%, 1/4W	745-7958-220
R119	RESISTOR, FIXED, FILM, 5620 OHMS, 1%, 1/8W (EFF REV M)	745-7956-980
R119	RESISTOR, FIXED, COMPOSITION, 4.7K, ±5%, 1/4W	745-7958-250
R120	RESISTOR, FIXED, FILM, 5110 OHMS, ±1%, 1/8W	745-7956-940
R121	RESISTOR, FIXED, COMPOSITION, 1K, ±5%, 1/4W	745-7958-170
R122	RESISTOR, FIXED, COMPOSITION, 1.5K, ±5%, 1/4W	745-7958-190
R123	RESISTOR, FIXED, COMPOSITION, 56K, ±5%, 1/4W	745-7958-390
R124	RESISTOR, FIXED, FILM, 3320 OHMS, 1%, 1/8W (EFF REV M)	745-7956-760
R124	RESISTOR, FIXED, COMPOSITION, 3.3K, ±5%, 1/4W	745-7958-230

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
R125	RESISTOR, FIXED, FILM, 5620 OHMS, 1%, 1/8W (EFF REV M)	745-7956-980
R125	RESISTOR, FIXED, COMPOSITION, 5.6K, ±5%, 1/4W	745-7958-260
R126	RESISTOR, FIXED, COMPOSITION, 1K, ±5%, 1/4W	745-7958-170
R127	RESISTOR, VARIABLE, 500 OHMS, ±20%, 1/2W	382-0045-040
R128	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R129	RESISTOR, FIXED, COMPOSITION, 10K, ±5%, 1/4W	745-7958-290
R130	RESISTOR, FIXED, COMPOSITION, 18K, ±5%, 1/4W	745-7958-320
R131	RESISTOR, VARIABLE, 1K, ±20%, 1/2W	382-0045-010
R132	RESISTOR, FIXED, FILM, 2210 OHMS, 1%, 1/8W (EFF REV M)	745-7956-590
R132	RESISTOR, FIXED, COMPOSITION, 2.2K, ±5%, 1/4W	745-7958-210
R133	RESISTOR, VARIABLE, 1K, ±20%, 1/2W	382-0045-010
R134	RESISTOR, FIXED, FILM, 7500 OHMS, ±1%, 1/8W	745-7957-110
R135	RESISTOR, FIXED, FILM, 1130 OHMS, ±1%, 1/8W	745-7956-310
R136	RESISTOR, FIXED, FILM, 97.6K, ±1%, 1/8W	745-7403-190
R137	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R138	RESISTOR, FIXED, FILM, 8.45K, ±1%, 1/8W	745-7957-160
R139	RESISTOR, FIXED, FILM, 1.21K, ±1%, 1/8W	745-7956-340
R140	RESISTOR, FIXED, FILM, 107K, ±1%, 1/8W	745-7403-230
R141	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R142	RESISTOR, FIXED, FILM, 24.3K, ±1%, 1/8W	745-7957-600
R143	RESISTOR, FIXED, FILM, 24.3K, ±1%, 1/8W	745-7957-600
R144	RESISTOR, FIXED, COMPOSITION, 8.2K, ±5%, 1/4W	745-7958-280
R145	RESISTOR, FIXED, COMPOSITION, 560 OHMS, ±5%, 1/4W	745-7958-140
R146	RESISTOR, FIXED, FILM, 11.8K, ±1%, 1/8W	745-7957-300
R147	RESISTOR, FIXED, FILM, 14.7K, ±1%, 1/8W	745-7957-390
R148	RESISTOR, FIXED, FILM, 14.7K, ±1%, 1/8W	745-7957-390
R149	RESISTOR, FIXED, COMPOSITION, 6.8K, ±5%, 1/4W	745-7958-270
R150	RESISTOR, FIXED, COMPOSITION, 560 OHMS, ±5%, 1/4W	745-7958-140
R151	RESISTOR, FIXED, FILM, 10.7K, ±1%, 1/8W	745-7957-260
R152	NOT USED	
R153	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±5%, 1/4W	745-7958-120
R154	RESISTOR, FIXED, COMPOSITION, 10 OHMS, ±5%, 1/4W	745-7958-020
R155	RESISTOR, FIXED, COMPOSITION, 390 OHMS, ±5%, 1/4W	745-7958-100
R156	RESISTOR, FIXED, COMPOSITION, 4.7K, ±5%, 1/4W	745-7958-250
R157	RESISTOR, FIXED, COMPOSITION, 6.8K, ±5%, 1/4W	745-7958-270
R158	RESISTOR, FIXED, COMPOSITION, 1K, ±5%, 1/4W	745-7958-170
R159	RESISTOR, FIXED, COMPOSITION, 1.5K, ±5%, 1/4W	745-7958-190
R160	RESISTOR, FIXED, COMPOSITION, 3.3K, ±5%, 1/4W	745-7958-230
R161	RESISTOR, FIXED, COMPOSITION, 2.2K, ±5%, 1/4W	745-7958-210
R162	RESISTOR, FIXED, COMPOSITION, 33K, ±5%, 1/4W	745-7958-350
R163	RESISTOR, FIXED, COMPOSITION, 47 OHMS, ±5%, 1/4W	745-7958-530
R164	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±5%, 1/4W	745-7958-070
R165	RESISTOR, FIXED, COMPOSITION, 3.3K, ±5%, 1/4W	745-7958-230
R166	RESISTOR, FIXED, COMPOSITION, 8.2K, ±5%, 1/4W	745-7958-280
R167	NOT USED	
R168	RESISTOR, FIXED, COMPOSITION, 100K, ±5%, 1/4W	745-7958-420
R169	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R170	RESISTOR, FIXED, COMPOSITION, 33K, ±5%, 1/4W	745-7958-350

*FACTORY TEST SELECT - REPLACE WITH SAME VALUE

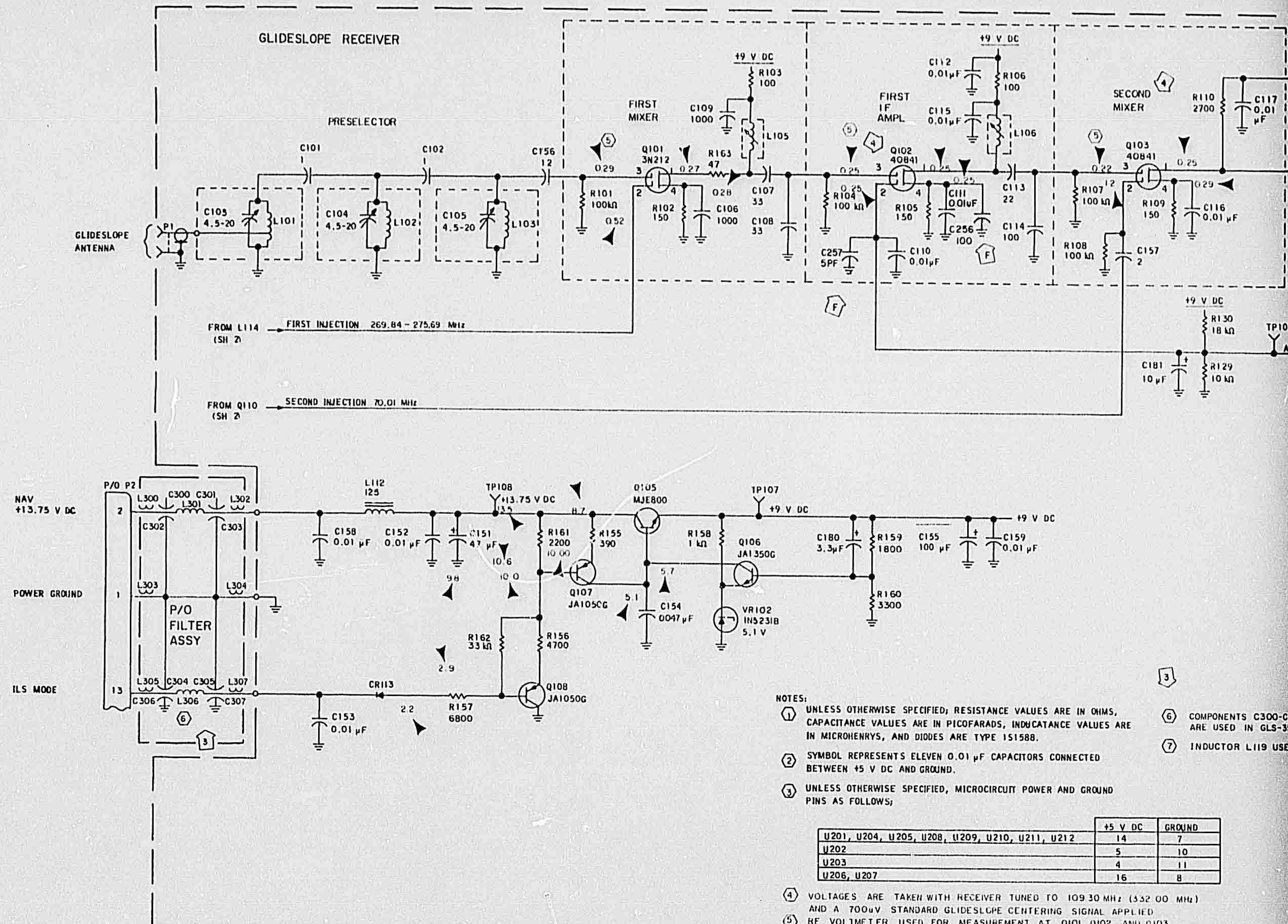
PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
R171	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
*R172	RESISTOR, FXD, CMPSN, 100 OHMS, 5%, 1/4W	745-7958-030
*R172	RESISTOR, FXD, CMPSN, 120 OHMS, 5%, 1/4W	745-7958-040
*R172	RESISTOR, FXD, CMPSN, 150 OHMS, 5%, 1/4W	745-7958-050
*R172	RESISTOR, FXD, CMPSN, 180 OHMS, 5%, 1/4W	745-7958-060
*R172	RESISTOR, FXD, CMPSN, 220 OHMS, 5%, 1/4W	745-7958-070
*R172	RESISTOR, FXD, CMPSN, 270 OHMS, 5%, 1/4W	745-7958-080
*R172	RESISTOR, FXD, CMPSN, 330 OHMS, 5%, 1/4W	745-7958-090
*R172	RESISTOR, FXD, CMPSN, 390 OHMS, 5%, 1/4W	745-7958-100
*R172	RESISTOR, FXD, CMPSN, 470 OHMS, 5%, 1/4W	745-7958-120
*R172	RESISTOR, FXD, CMPSN, 510 OHMS, 5%, 1/4W	745-7958-130
*R172	RESISTOR, FXD, CMPSN, 560 OHMS, 5%, 1/4W	745-7958-140
*R172	RESISTOR, FXD, CMPSN, 680 OHMS, 5%, 1/4W	745-7958-150
*R172	RESISTOR, FXD, CMPSN, 820 OHMS, 5%, 1/4W	745-7958-160
R173-R200	NOT USED	
R201	RESISTOR, FIXED, COMPOSITION, 1K, ±5%, 1/4W	745-7958-170
R202	RESISTOR, FIXED, COMPOSITION, 820 OHMS ±10%, 1/4W	745-7950-240
R203	RESISTOR, FIXED, COMPOSITION, 2.2K, ±5%, 1/4W	745-7958-210
R204	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R205	RESISTOR, FIXED, COMPOSITION, 2.2K, ±5%, 1/4W	745-7958-210
R206	RESISTOR, FIXED, COMPOSITION, 2.7K, ±5%, 1/4W	745-7958-220
R207	RESISTOR, FIXED, COMPOSITION, 330 OHMS, ±5%, 1/4W	745-7958-090
R208	RESISTOR, FIXED, COMPOSITION, 47K, ±5%, 1/4W	745-7958-370
R209	RESISTOR, FIXED, COMPOSITION, 4.7K, ±5%, 1/4W	745-7958-250
R210	RESISTOR, FIXED, COMPOSITION, 5.6K, ±5%, 1/4W	745-7958-260
R211	RESISTOR, FIXED, COMPOSITION, 560 OHMS, ±5%, 1/4W	745-7958-140
R212	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R213	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R214	RESISTOR, FIXED, COMPOSITION, 6.8K, ±5%, 1/4W	745-7958-270
R215	RESISTOR, FIXED, COMPOSITION, 4.7K, ±5%, 1/4W	745-7958-250
R216	RESISTOR, FIXED, COMPOSITION, 150 OHMS, ±5%, 1/4W	745-7958-050
R217	RESISTOR, FIXED, COMPOSITION, 4.7K, ±5%, 1/4W	745-7958-250
R218	RESISTOR, FIXED, COMPOSITION, 270 OHMS, ±5%, 1/4W	745-7958-080
R219	RESISTOR, FIXED, COMPOSITION, 6.8K, ±5%, 1/4W	745-7958-270
R220	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±5%, 1/4W	745-7958-120
R221	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R222	RESISTOR, FIXED, COMPOSITION, 470 OHMS, ±5%, 1/4W	745-7958-120
R223	RESISTOR, FIXED, COMPOSITION, 22K, ±5%, 1/4W	745-7958-330
R224	RESISTOR, FIXED, COMPOSITION, 100 OHMS, ±5%, 1/4W	745-7958-030
R225	RESISTOR, FIXED, COMPOSITION, 1.8K, ±5%, 1/4W	745-7958-200
R226	RESISTOR, FIXED, COMPOSITION, 560 OHMS, ±5%, 1/4W	745-7958-140
R227-R230	NOT USED	
R231	RESISTOR, FIXED, COMPOSITION, 1K, ±5%, 1/4W	745-7958-170
R232	RESISTOR, FIXED, COMPOSITION, 1K, ±5%, 1/4W	745-7958-170
R233	RESISTOR, FIXED, COMPOSITION, 15K, ±5%, 1/4W	745-7958-310
R234	RESISTOR, FIXED, COMPOSITION, 15K, ±5%, 1/4W	745-7958-310
R235	RESISTOR, FIXED, COMPOSITION, 15K, ±5%, 1/4W	745-7958-310

*FACTORY TEST SELECT - REPLACE WITH SAME VALUE

PARTS LIST
GLS-350/350E GLIDESLOPE RECEIVER

SYMBOL	DESCRIPTION	PART NUMBER
R236	RESISTOR, FIXED, COMPOSITION, 15K, ±5%, 1/4W	745-7958-310
R237	RESISTOR, FIXED, COMPOSITION, 15K, ±5%, 1/4W	745-7958-310
R238	RESISTOR, FIXED, COMPOSITION, 15K, ±5%, 1/4W	745-7958-310
R239	RESISTOR, FIXED, COMPOSITION, 220 OHMS, ±5%, 1/4W	745-7958-070
R240	RESISTOR, FIXED, COMPOSITION, 4.7K, ±5%, 1/4W	745-7958-250
RT1- RT100	NOT USED	
RT101	THERMISTOR, DISK TYPE, D33A, 2.5K	714-3256-010
T1- T200	NOT USED	
T201	TRANSFORMER	278-0420-020
U1- U100	NOT USED	
U101	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U102	INTEGRATED CIRCUIT, MC1350P	351-1134-010
U103	INTEGRATED CIRCUIT, MC1458CP1	351-1156-020
U104	INTEGRATED CIRCUIT, MC1458CP1	351-1156-020
U105	INTEGRATED CIRCUIT, MC1458CP1	351-1156-020
U106- U200	NOT USED	
U201	INTEGRATED CIRCUIT, 7400	351-1548-020
U202	INTEGRATED CIRCUIT, 7493	351-1552-020
U203	INTEGRATED CIRCUIT, 74H73	351-1550-050
U204	INTEGRATED CIRCUIT, 7400	351-1548-020
U205	INTEGRATED CIRCUIT, 7470	351-1550-040
U206	INTEGRATED CIRCUIT, 74191	351-1596-020
U207	INTEGRATED CIRCUIT, 74191	351-1596-020
U208	INTEGRATED CIRCUIT, 7400	351-1548-020
U209	INTEGRATED CIRCUIT, 7410	351-1548-060
U210	INTEGRATED CIRCUIT, 74H52	351-1610-010
U211	INTEGRATED CIRCUIT, 74H52	351-1610-010
U212	INTEGRATED CIRCUIT, 7404	351-1548-030
VR1- VR100	NOT USED	
VR101	ZENER DIODE, 1N5231B, 5.1V	353-3740-210
VR102	ZENER DIODE, 1N5231B, 5.1V	353-3740-210
VR103- VR200	NOT USED	
VR201	ZENER DIODE, 1N5231B, 5.1V	353-3740-210
Y1- Y100	NOT USED	
Y101	OSCILLATOR, CRYSTAL, 70.01 MHZ	289-7260-010
Y102- Y200	NOT USED	
Y201	OSCILLATOR, CRYSTAL, 2.4 MHZ	289-7219-010



NOTES:

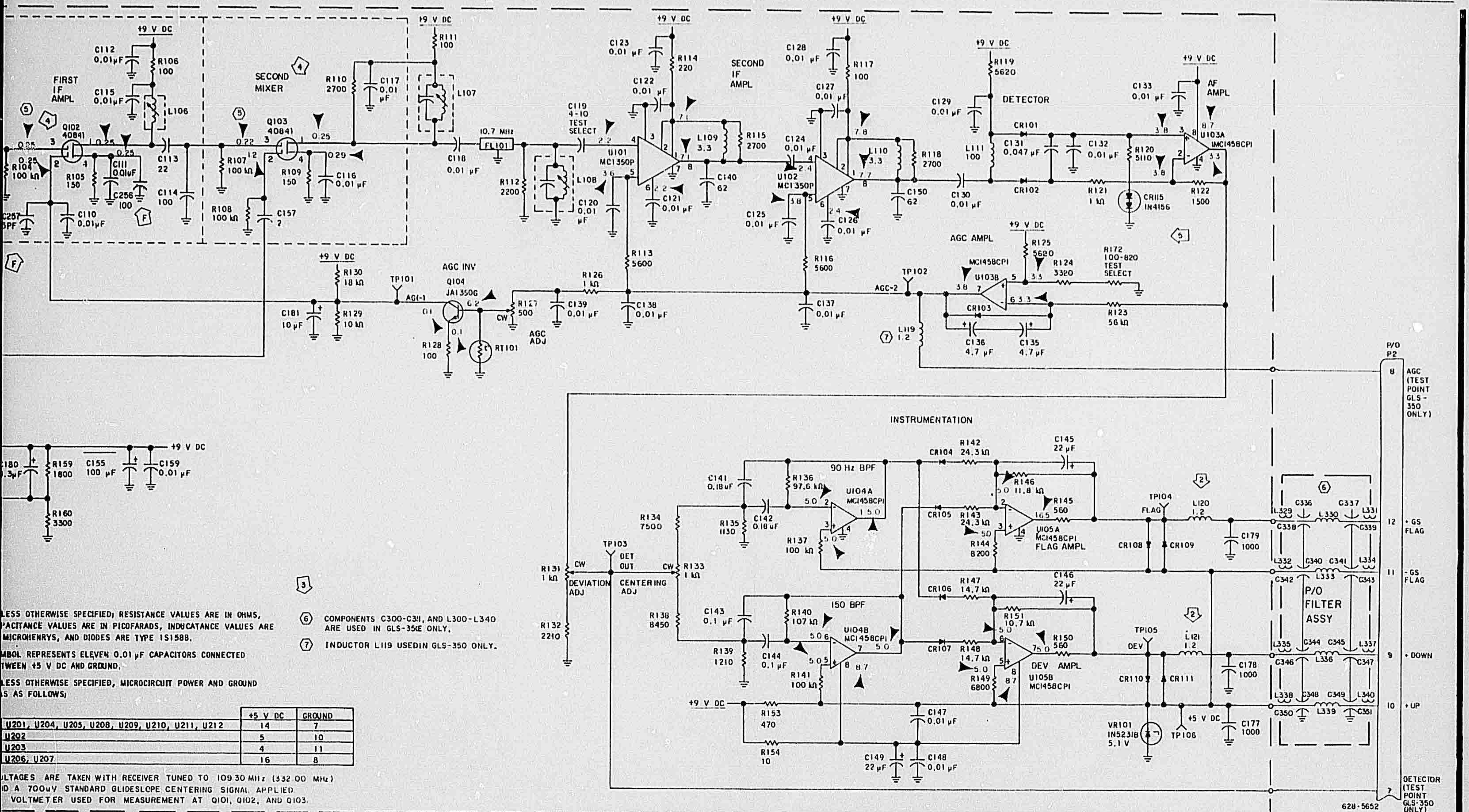
1. UNLESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN PICOFARADS, INDUCTANCE VALUES ARE IN MICROHENRYS, AND DIODES ARE TYPE 151588.
2. SYMBOL REPRESENTS ELEVEN 0.01 μF CAPACITORS CONNECTED BETWEEN +5 V DC AND GROUND.
3. UNLESS OTHERWISE SPECIFIED, MICROCIRCUIT POWER AND GROUND PINS AS FOLLOWS;

	+5 V DC	GROUND
U201, U204, U205, U208, U209, U210, U211, U212	14	7
U202	5	10
U203	4	11
U206, U207	16	8

4. VOLTAGES ARE TAKEN WITH RECEIVER TUNED TO 109.30 MHz (332.00 MHz) AND A 700μV STANDARD GLIDESLOPE CENTERING SIGNAL APPLIED
5. RF VOLTMETER USED FOR MEASUREMENT AT Q101, Q102, AND Q103.
6. COMPONENTS C300-C3 ARE USED IN GLS-35
7. INDUCTOR L119 USEC

SEE BLOW-UP FICHE NO. CRL104 - ITEM E

6-17-6*18



LESS OTHERWISE SPECIFIED; RESISTANCE VALUES ARE IN OHMS, PACITANCE VALUES ARE IN PICOFARADS, INDUCATANCE VALUES ARE MICROHENRYS, AND DIODES ARE TYPE 1S1588.

MBOL REPRESENTS ELEVEN 0.01 µF CAPACITORS CONNECTED TWEEN +5 V DC AND GROUND.

LESS OTHERWISE SPECIFIED, MICROCIRCUIT POWER AND GROUND S AS FOLLOWS;

	+5 V DC	GROUND
U201, U204, U205, U208, U209, U210, U211, U212	14	7
U202	5	10
U203	4	11
U206, U207	16	8

LTAGES ARE TAKEN WITH RECEIVER TUNED TO 109.30 MHz (332.00 MHz) D A 700uV STANDARD GLIDESLOPE CENTERING SIGNAL APPLIED VOLTMETER USED FOR MEASUREMENT AT Q101, Q102, AND Q103.

(6) COMPONENTS C300-C341, AND L300-L340 ARE USED IN GLS-350E ONLY.

(7) INDUCTOR L119 USEDIN GLS-350 ONLY.

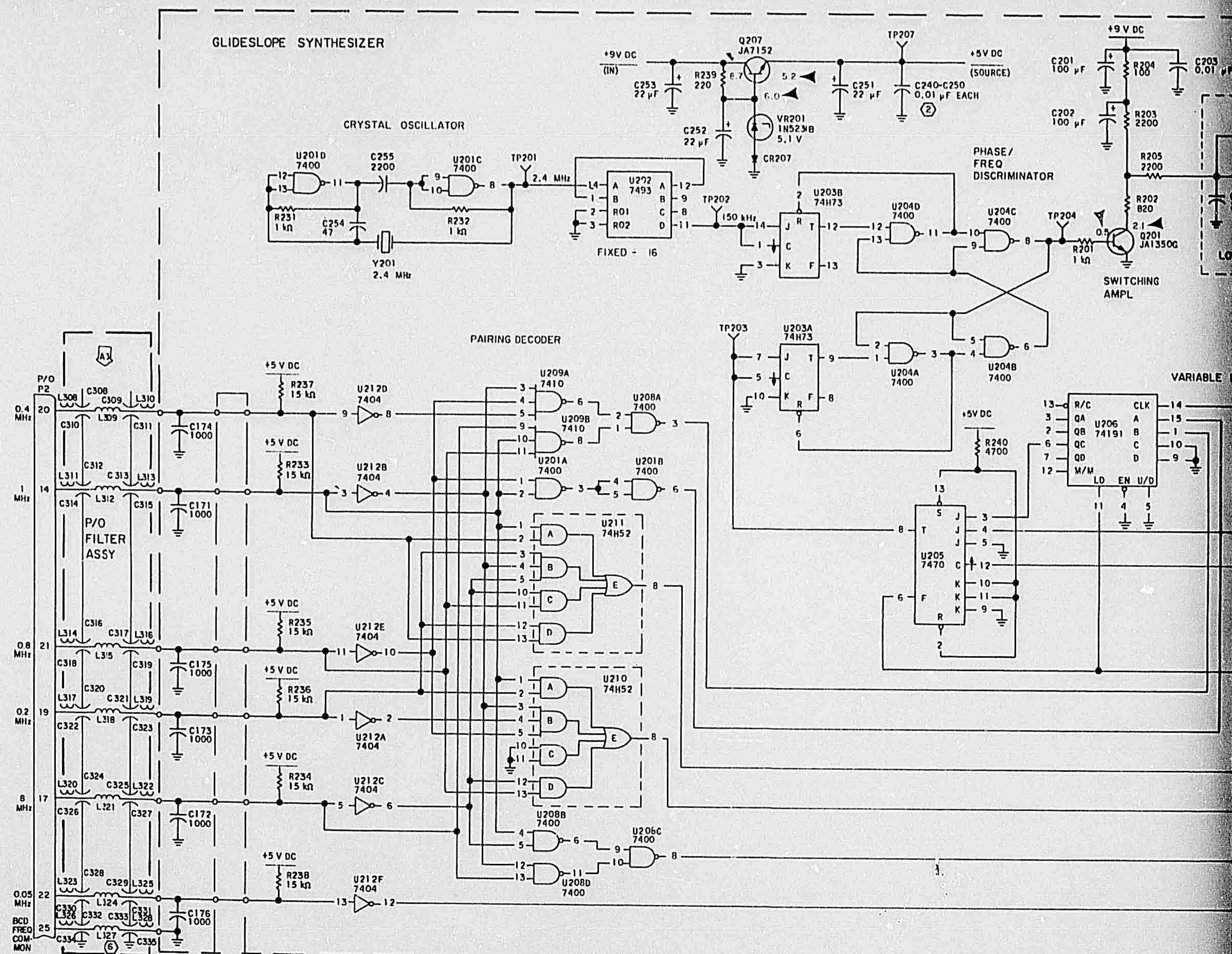
GLS-350/350E Receiver/Instrumentation, Schematic Diagram
Figure 6-2

SEE BLOW-UP FICHE NO. CRL104 - ITEM E

SCHEMATIC CHANGES

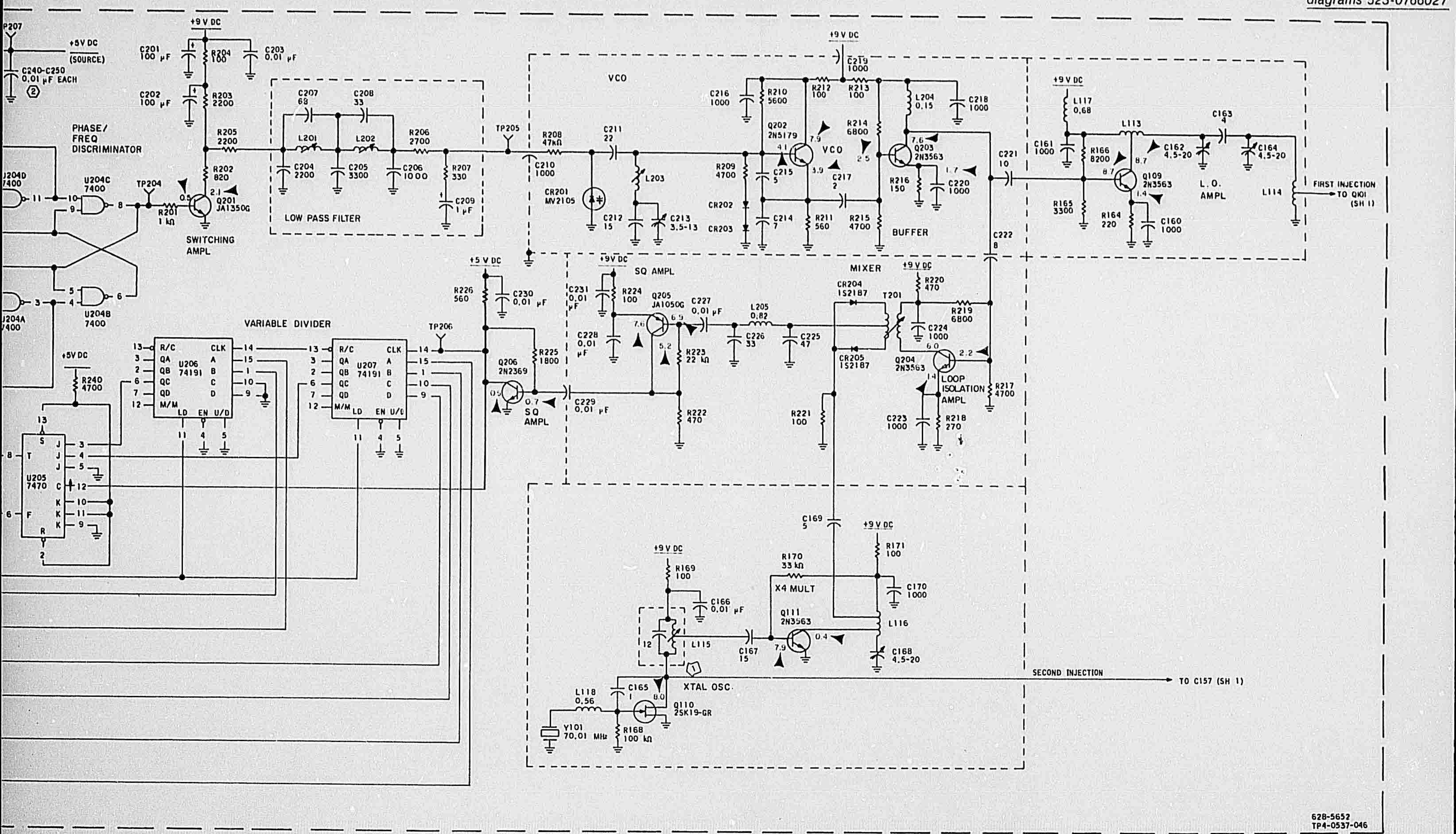
REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Schematic correction; add connection dot at junction point of C165 and Q110 drain.	NA	All models
3	Added GLS-350E filter components.	NA	GLS-350E

GLS-350/350E Synthesizer, Schematic Diagram
Figure 6-3 (Sheet A)



SEE BLOW–UP FICHE NO. CRL104 - ITEM I

6-21/622



GLS-350/350E Synthesizer, Schematic Diagram
Figure 6-3

SEE BLOW-UP FICHE NO. CRL104 - ITEM 1

Collins GLS-350/350E Glideslope Receiver

Rockwell International

bulletins

Collins General Aviation Division

Printed in USA

523-0766028-004118
4th Edition, 9 June 1982

Service Bulletins and Service Information Letters Issued to Date

SB/SIL Number	*Unit*	*Title*	*Date*
1	GLS-350	Reduction of Susceptibility to Interference by VHF Transmissions	Feb 14/76
2	GLS-350	Prevention of Receiver Oscillation	Oct 22/79
1	GLS-350E	Prevention of Receiver Oscillation	Oct 22/79
1-76	GLS-350/350E	Pairing Decoder Damage	Aug 1/76

NOTICE: This title page replaces third edition title page dated 1 June 1978.

03

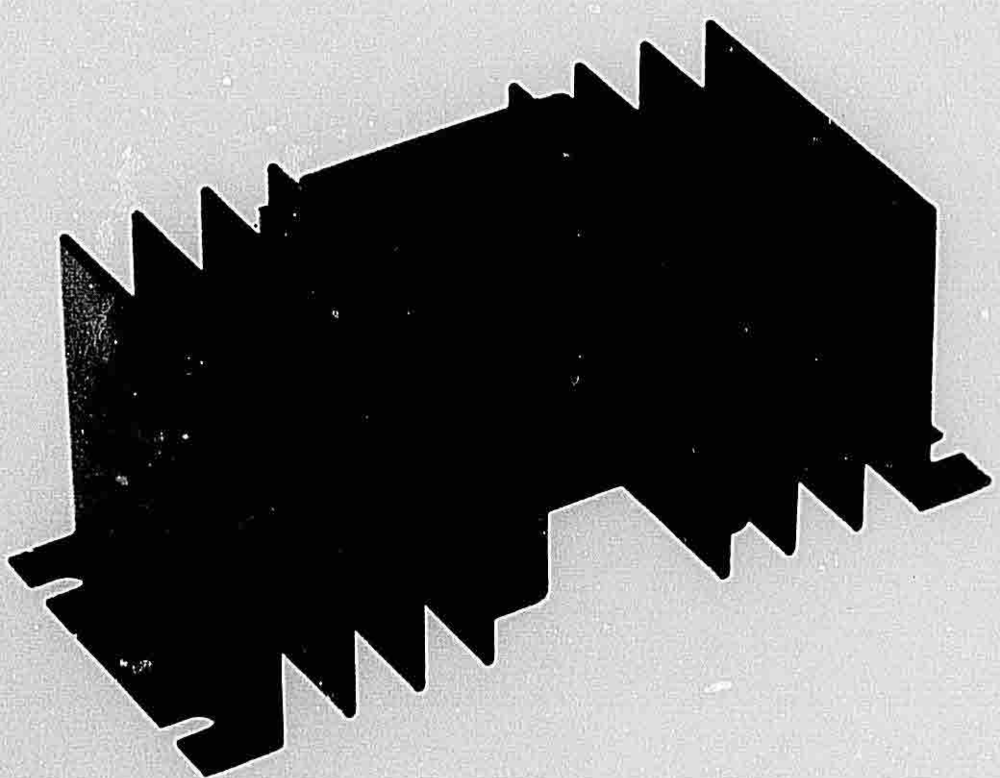
Collins General Aviation Division
Cedar Rapids, Iowa 52498

Rockwell International

instruction book supplement

MICRO LINE

Collins 28- to 14-V DC Adapter



628-8162

523-0769630-00211J 7-84 Printed in U.S.A.

section I
description

1.1 INTRODUCTION

This supplement contains all the specifications, installation instructions, and maintenance information necessary to install and maintain the Collins 28- to 14-V dc Adapter, Collins part number 628-7990-001.

1.2 PURPOSE OF THE EQUIPMENT

The purpose of the 28- to 14-volt adapter is to provide regulated power to selected Collins Micro Line units installed in 28-volt systems; prior to adapter availability, these units required dropping resistors when installed in 28-volt aircraft. The adapter is specifically designed for use with the Collins AMR-350/350H Audio/Marker Panel, AUD-250/250H/251H Audio Panel, GLS-350/350E Glideslope Receiver, RCR-650/650A Receiver (part of the ADF-650/650A Automatic Direction Finder System), TDR-950/950L Transponder, and VIR-350/351 Navigation Receiver. Benefits derived from utilization of this adapter in 28-volt systems include improved performance and reliability.

1.3 DESIGN FEATURES

- Simple design for maximum reliability.
- Compact size, light weight, and remote mounting in any position for ease of installation.
- Elimination of dropping resistors contributes to improved performance and reliability of the associated equipment.

1.4 EQUIPMENT SPECIFICATIONS

Table 1-1 lists the equipment specifications for the 28- to 14-volt adapter.

Table 1-1. 28- to 14-Volt Adapter, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Physical	
Dimensions	
Width	57.91 mm (2.28 in).
Height	50.80 mm (2.00 in).
Length	121.16 mm (4.77 in).
Mounting	Secured to airframe in any position, no mounting tray required.
Weight	0.22 kg (0.48 lb).
Environmental	
Temperature range	−40 to +55 °C (−40 to +131 °F).
Altitude	7 620 m (25 000 ft).
Cooling	Convection.
Relative humidity	95% at +50 °C (+122 °F) for 48 hours.

Table 1-1. 28- to 14-Volt Adapter, Equipment Specifications (Cont).

Shock	
Operational	15 g.
Crash safety	30 g.
Electrical	
Power requirements	27.5 V dc ±10% at 2 A maximum.
Output voltage	12.5 V dc ±10% for load current range of 0.26 to 1.3 A and 22 to 33 V dc line voltage.
Rated output current	1.3 A continuous.
Input current consumption	Equals output current plus 100 mA maximum.
Voltage regulation	±10% maximum change over 0.26 to 1.3 A load current and 22 to 33 V dc line voltage.

1.5 EQUIPMENT SUPPLIED

Included with the 28- to 14-volt adapter are three terminals, CPN 304-1551-020, for wiring harness termination at the adapter.

1.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Four #6 panhead screws and flat washers are required to secure the 28- to 14-volt adapter in place.

section II
installation

2.1 GENERAL

This section contains all the information necessary to install the 28- to 14-volt adapter in an aircraft and to ensure operational readiness after installation.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Unpack the equipment carefully and make a visual inspection of each unit for possible shipping damage. All claims for damage should be filed with the transportation company involved. If claims for damage are to be filed, save the original shipping carton and materials. If no defects can be detected, replace packing materials in the shipping container and save for future uses such as storage or reshipment.

2.3 SPECIAL INSTRUCTIONS

The 28- to 14-volt adapter radiates heat. When selecting a mounting position, ensure that adequate air circulation is provided for cooling.

2.4 INSTALLATION PROCEDURES

The following installation procedures must be performed as described to ensure proper operation and performance.

a. Avoid mounting the adapter close to temperature-sensitive equipment.
b. Rigidly mount the adapter to the airframe. Mounting may be in any convenient location or position where adequate air circulation is available. Use four #6 panhead screws and flat washers to secure the adapter in place.
c. Refer to figure 2-1 for adapter outline and mounting dimensions.

2.5 CABLING

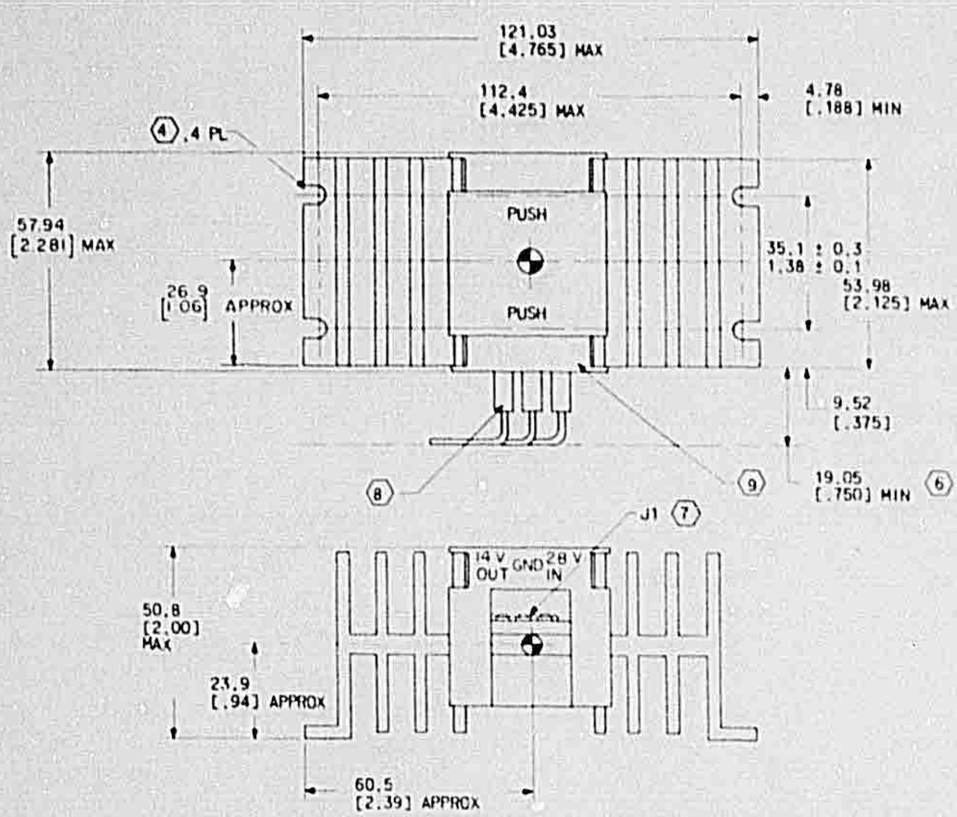
All connections to the 28- to 14-volt adapter are made through the terminal block located on the side of the unit. Crimp-type terminals are included with the adapter for ease of installation. Refer to figure 2-1 for terminal board lug assignments. Figure 2-2 shows partial interconnect wiring diagrams for those units that may be used with the adapter. During preparation of the interconnect wiring cables, observe the following precautions:

a. Be sure to observe the minimum specified wire gage sizes included on the interconnect wiring diagrams.
b. When preparing the wiring harness, use an AMP crimping tool (AMP No 47386, CPN 304-8003-020) to fasten the harness wires to the terminals provided with the adapter.
c. When fastening the wiring harness to the adapter terminal board, use the unit cover labeling as a guide in selecting the correct input and output terminals.

2.6 POSTINSTALLATION CHECKS

Postinstallation checks are to be performed with the 28- to 14-volt adapter and its associated equipment installed in the aircraft. Checks should be made using the aircraft power supply with the engine running.

a. Set the radio master switch to OFF if the aircraft is equipped with this feature. All individual units equipped with an ON/OFF control should be switched to OFF.
b. Start the aircraft and switch the radio master to ON after engine(s) is (are) running smoothly.
c. Perform the postinstallation test procedures for each unit for which power is supplied by the 28- to 14-volt adapter.

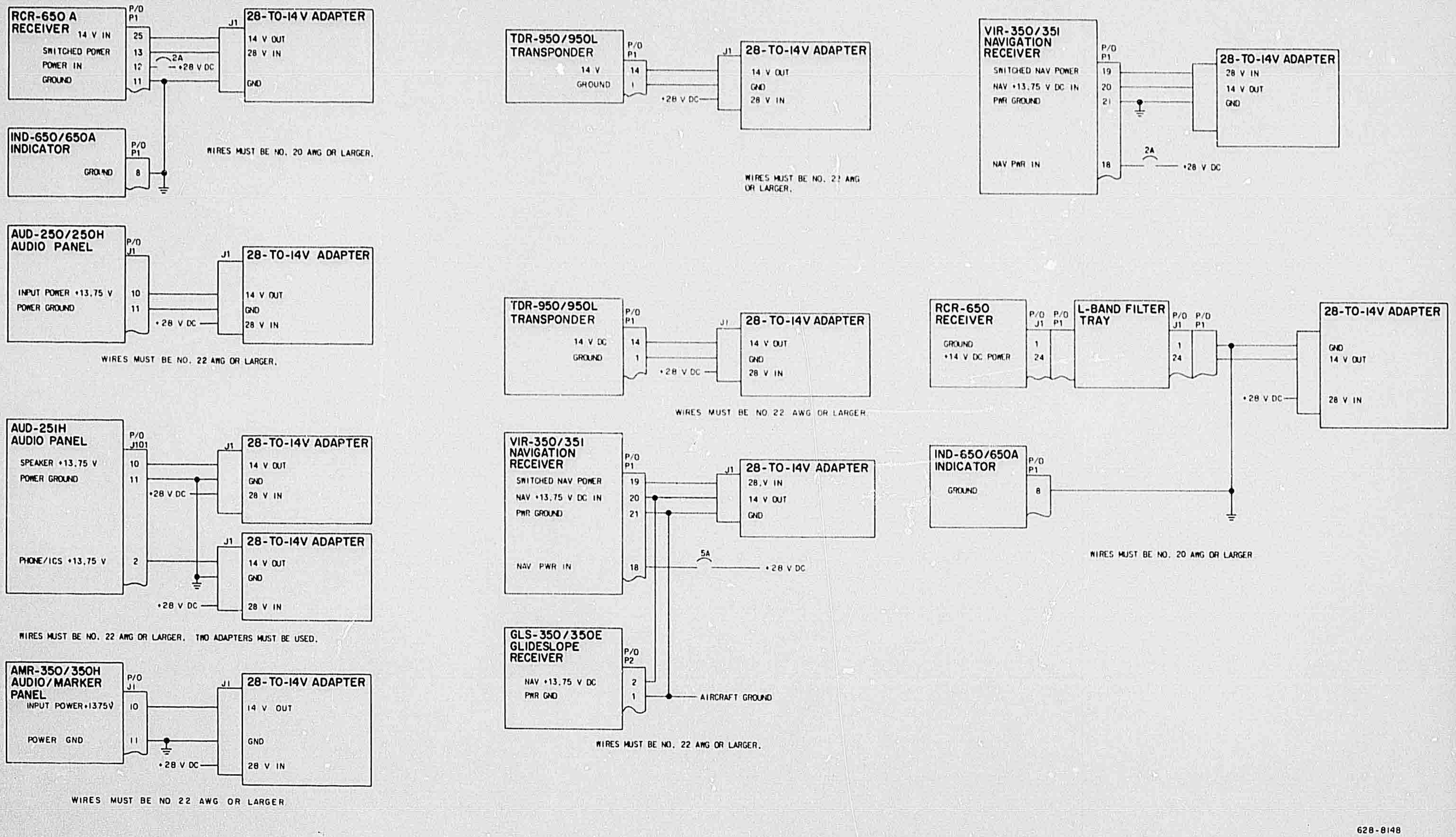


NOTES:

1. DIMENSIONS ARE IN MILLIMETERS [INCHES].
2. WEIGHT: 0.22 KG [48 LB]
3. THIS DRAWING APPLIES TO 628-7990-001
4. SLOTS PROVIDED FOR MOUNTING UNIT. USE NO. 6 PAN HEAD SCREW AND FLAT WASHER (NOT SUPPLIED).
5. DENOTES CENTER OF GRAVITY.
6. RECOMMENDED CLEARANCE FOR TERMINALS AND WIRES.
7. UNIT CONNECTOR J1 IS A TRW/CINCH 172 SERIES BARRIER BLOCK 351-27-03-001 (CPN 367-1887-020).
8. TERMINALS FOR UNIT CONNECTOR J1, SUPPLIED WITH UNIT, ARE TYPED 320773 FOR 22-16 AWG WIRE AND NO. 2 STUD MANUFACTURED BY AMP INCORPORATED (CPN 304-1551-020). USE AMP INC. CRIMP TOOL NO. 47386 (CPN 304-8003-020)
9. UNIT COVER MUST BE REMOVED TO INSTALL TERMINALS ON J1 CONNECTOR. WHEN INSTALLING COVER PRESS WITH FINGER IN AREA NOTED ON COVER (2) TWO PLACES UNTIL SNAP LOCK IS FELT.

628-8072

28- to 14-Volt Adapter, Outline and Mounting Dimensions
Figure 2-1



Partial Interconnect Wiring Diagrams
Figure 2-2

section III
maintenance

3.1 GENERAL

This section provides the information necessary to maintain, repair, and test the 28- to 14-volt adapter.

The 28- to 14-volt adapter requires no routine maintenance other than periodic inspections to ensure the unit has not sustained physical damage.

3.2 TEST EQUIPMENT

Table 3-1 lists the equipment required to test, troubleshoot, and repair the 28- to 14-volt adapter.

3.3 PERFORMANCE TEST

Test procedures are performed using the test setup shown in figure 3-1. The load placed on the 28- to 14-volt adapter will vary for different tests; these loads are noted in the appropriate test.

Caution

During testing the adapter may become too hot to touch with unprotected hands. Be careful to avoid burns when handling.

a. Connect the test equipment to the 28- to 14-volt adapter as shown in figure 3-1. Use the 10-ohm, 30-watt resistor as a load.
b. Increase power supply output until voltmeter indicates 22.0 V dc, and observe oscilloscope. Result: output ripple is less than 20 mV p-p.
c. Without changing power supply output, measure adapter output voltage at 14 V OUT. Result: adapter output voltage is 12.5 V dc ±10%.
d. Increase power supply output level to 33.0 V dc, and observe adapter output voltage. Result: adapter output voltage is 12.5 V dc ±10%.
e. Observe adapter output ripple on oscilloscope. Result: output ripple is less than 20 mV p-p.
f. Remove 10-ohm resistor and replace with 51-ohm, 6-watt load resistor. Observe adapter output level. Result: adapter output voltage is 12.5 V dc ±10%.
g. Observe voltage ripple across load resistor. Result: ripple is less than 20 mV p-p.
h. Decrease power supply output level to 22.0 V dc, and observe adapter output voltage at 14 V OUT. Result: adapter output voltage is 12.5 V dc ±10%.
i. Observe voltage ripple across load resistor. Result: ripple is less than 20 mV p-p.

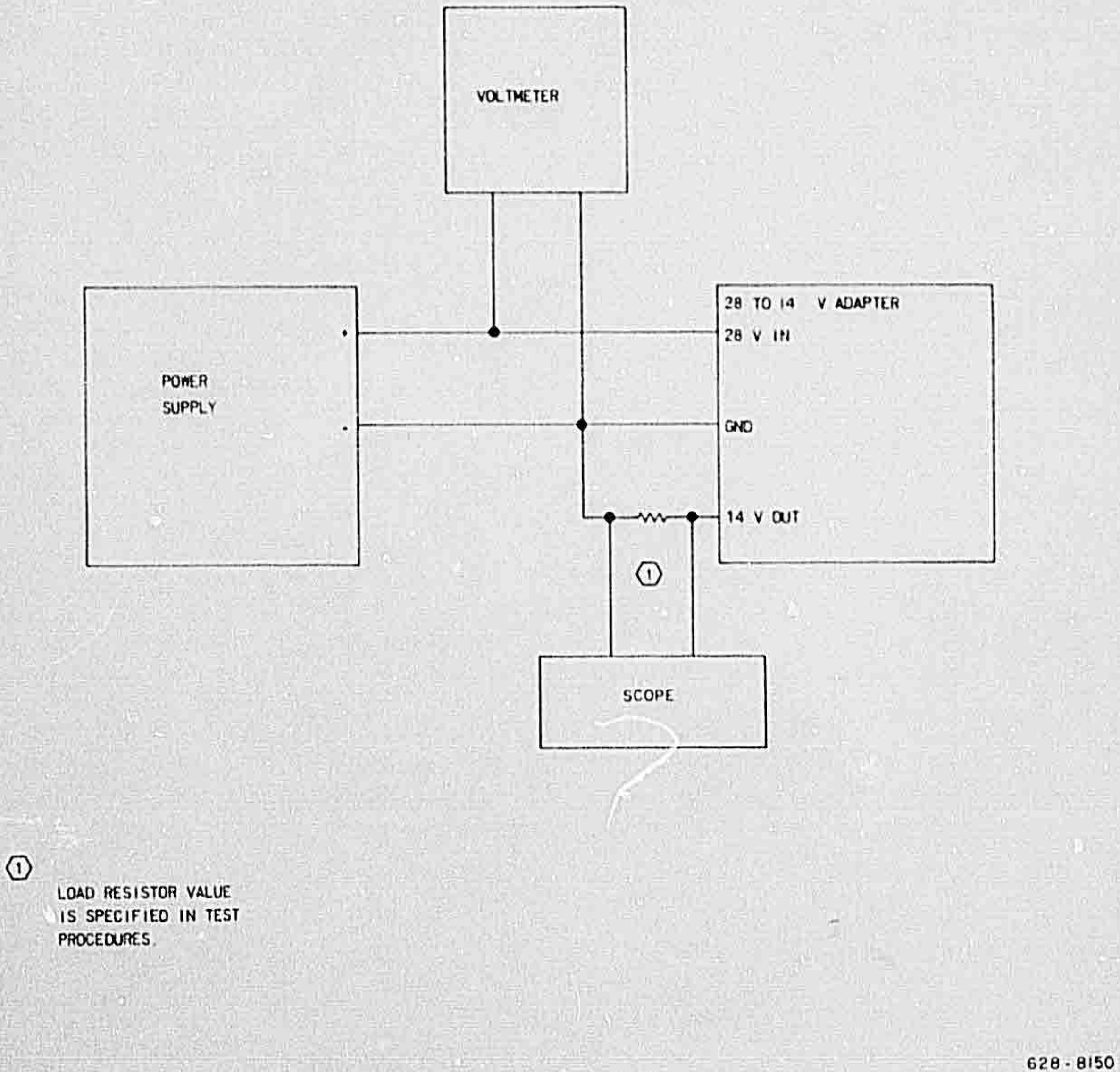
Table 3-1. Test Equipment Required.

EQUIPMENT	CHARACTERISTICS REQUIRED	REPRESENTATIVE TYPE
Dc power supply	0 to 35 V dc (variable), 1.5 A	Any
Voltmeter	Input impedance: 1 megohm Range: 0 to 35 V dc	Fairchild 7000
Oscilloscope	Single or dual channel	Any
Resistor	10-ohm, 30-W minimum	Collins 747-2172-090
Resistor	51-ohm, 6-W minimum	Collins 747-2172-080

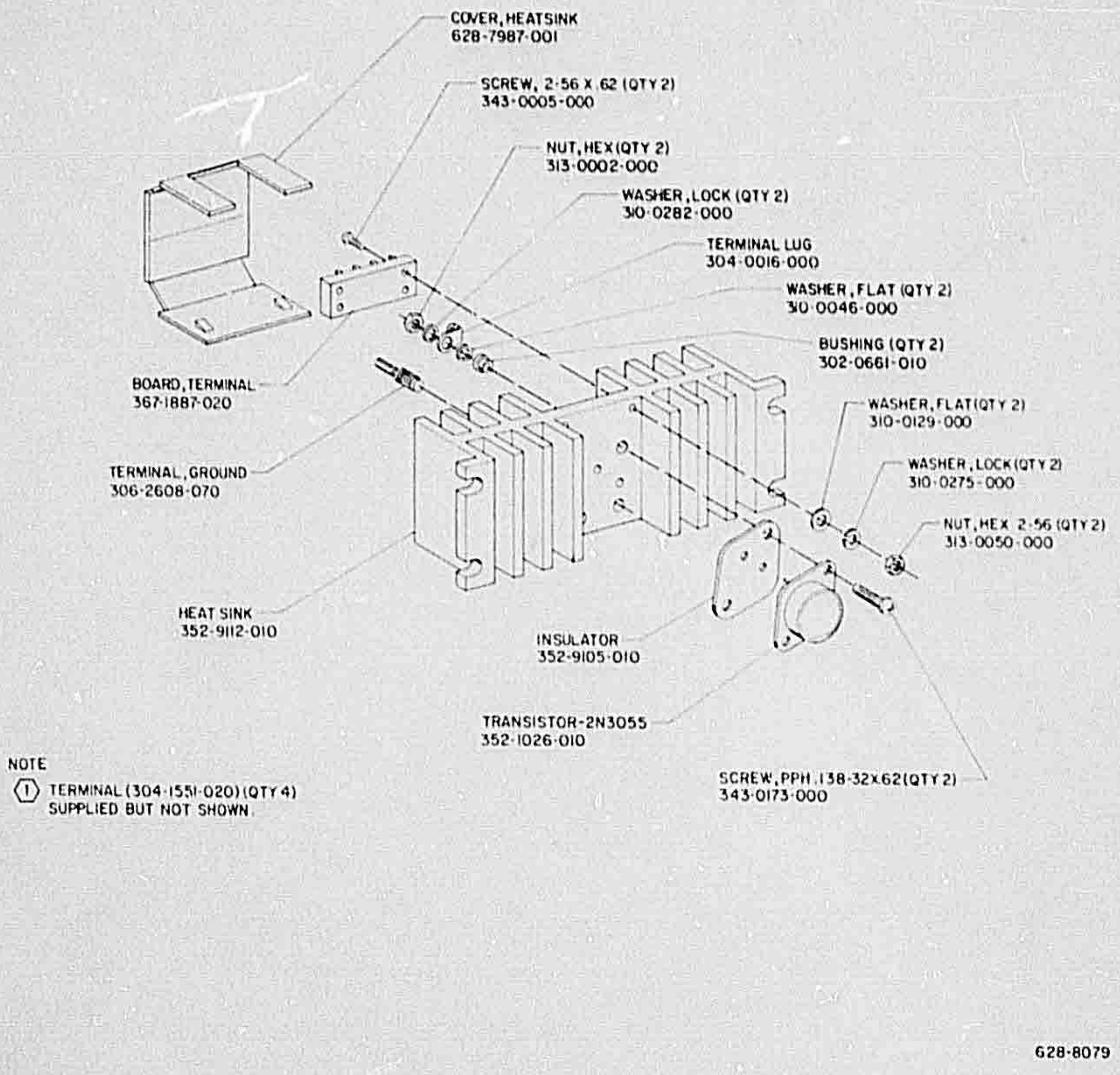
3.4 DISASSEMBLY/ASSEMBLY

The mechanical simplicity of the 28- to 14-volt adapter is illustrated in the exploded view shown in figure 3-2. There are no special procedures to be followed when disassembling the adapter. Reassembly, however, does require that the following special instructions be observed.

a. Heat-sink compound, Collins part number 005-1234-020 or equivalent, must be applied to both sides of the transistor mica insulator prior to reassembly. Remove any excess compound that is extruded when the transistor is tightened down.
b. Torque the nuts securing transistor Q1 in place 124.3 to 146.9 N•m (11 to 13 $lb_f \cdot in^2$).



Bench Test Setup
Figure 3-1



28- to 14-Volt Adapter, Exploded View
Figure 3-2

section IV
schematics

4.1 CONFIGURATION STATUS CONTROL

Collins General Aviation Division of Rockwell International uses the following method of identifying the configuration status of a unit or subassembly.

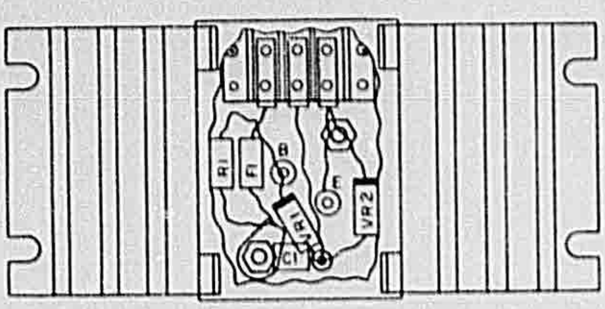
A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — if no changes have been processed. The first change will be identified as A, the second as B, continuing through Z to AA, AB, and ultimately to ZZ. Incorporation of design changes in a unit or subassembly that has been returned to Rockwell-Collins for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, if unit one is marked REV B — RWK F and unit two is marked REV F, this indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

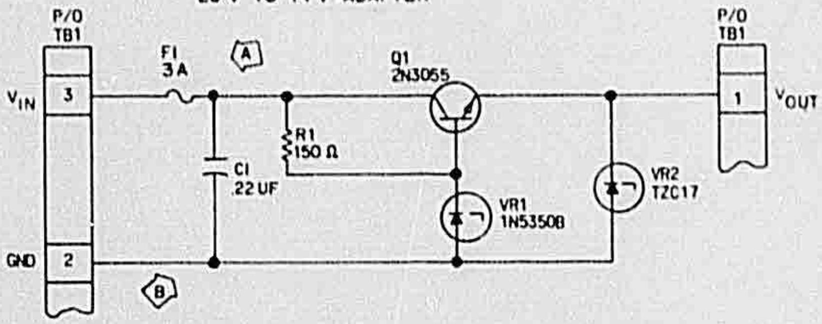
A reworked unit may not contain all design changes made to the reworked identifier but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may appear physically different from a newly manufactured unit with the same alphabetic identifier.

4.2 SCHEMATIC DIAGRAM

The 28- to 14-volt adapter component location diagram and schematic are shown in figures 4-1 and 4-2 respectively.



28- to 14-Volt Adapter, Component Location Diagram
Figure 4-1



REFERENCE DESIGNATOR	DESCRIPTION	COLLINS PART NUMBER
C1	Capacitor, fxd, ceramic, 0.22 μf, 20%, 50V	913-3306-080
FL1	Fuse, 3A	264-0968-040
Q1	Transistor, 2N3055	352-1026-010
R1	Resistor, Fxd, WW, 150 ohm, 5%, 6.5 W	747-5498-000
TB1	Connector	367-1887-020
VR1	Zener Diode, 1N5350B	353-6550-180
VR2	Zener Diode, TZC 17	353-0314-020

28- to 14-Volt Adapter, Schematic Diagram
Figure 4-2

AIRCRAFT TECHNICAL PUBLISHERS

MANUFACTURER: ROCKWELL/COLLINS

MODEL: TDR-950/950L TRANSPONDER

TYPE OF PUBLICATION: INSTRUCTION BOOK

GENERAL INDEX

523-0766464-00411A

Rockwell International

instruction book

Collins TDR-950/950L Transponder

This instruction book includes:

Description	523-0766465
Installation	523-0766466
Operation	523-0766467
Theory	523-0766468
Maintenance	523-0766469
Diagrams	523-0766470
Bulletins	523-0766471

Collins General Aviation Division
Avionics Group
Rockwell International
Cedar Rapids, Iowa 52498

Printed in the United States of America

ATP RECORD OF REVISIONS

AIRCRAFT TECHNICAL PUBLISHERS

MFG. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY
	REISSUE	8/1/84	12/21/84	ATP/SL

AIRCRAFT TECHNICAL PUBLISHERS

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID

Collins Divisions
Cedar Rapids, Iowa 52498
(319) 395-1000
Cable COLINRAD Cedar Rapids

Rockwell
International

October 15, 1984

TO: HOLDERS OF COLLINS TDR-950/950L TRANSPONDER INSTRUCTION BOOK (523-0766464)

FOURTH EDITION HIGHLIGHTS

The attached instruction book completely replaces the existing book.

This edition of the TDR-950/950L instruction book includes changes that have occurred since the last edition was published. The information for the AED-950 Altitude Encoding Digitizer has been removed. This product was never released to the field.

Remove your copies of service bulletins and service information letters in the bulletins section of your old book and place them behind the bulletins section divider page in the new book.

Revisions are indicated by a black bar in the margin. Retain this letter of transmittal for future reference.

PUBLICATIONS DEPARTMENT

Collins TDR-950/950L Transponder

Rockwell International

Description

description

Collins General Aviation Division

Printed in USA

523-0766465-004118
4th Edition, 1 August 1984

TDR-950/950L

table of contents

523-0766465-004118

NOTICE: This section replaces third edition dated 2 October 1978.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	15 Sep 75		None				
2nd Ed	1 Apr 76		SIL 1-75 thru 4-75; SIL 1-76; SB 1,2				
3rd Ed	2 Oct 78		Those above plus SB 3, 4, 5, 6, 7, 8; SIL 2-76 thru 5-76; SIL 1-77 thru 3-77; SIL 1-78, 2-78				
4th Ed	1 Aug 84	SL 12/21/84	SB 9,10 SIL 1-79, 2-82				

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

section I
description

1.1 INTRODUCTION

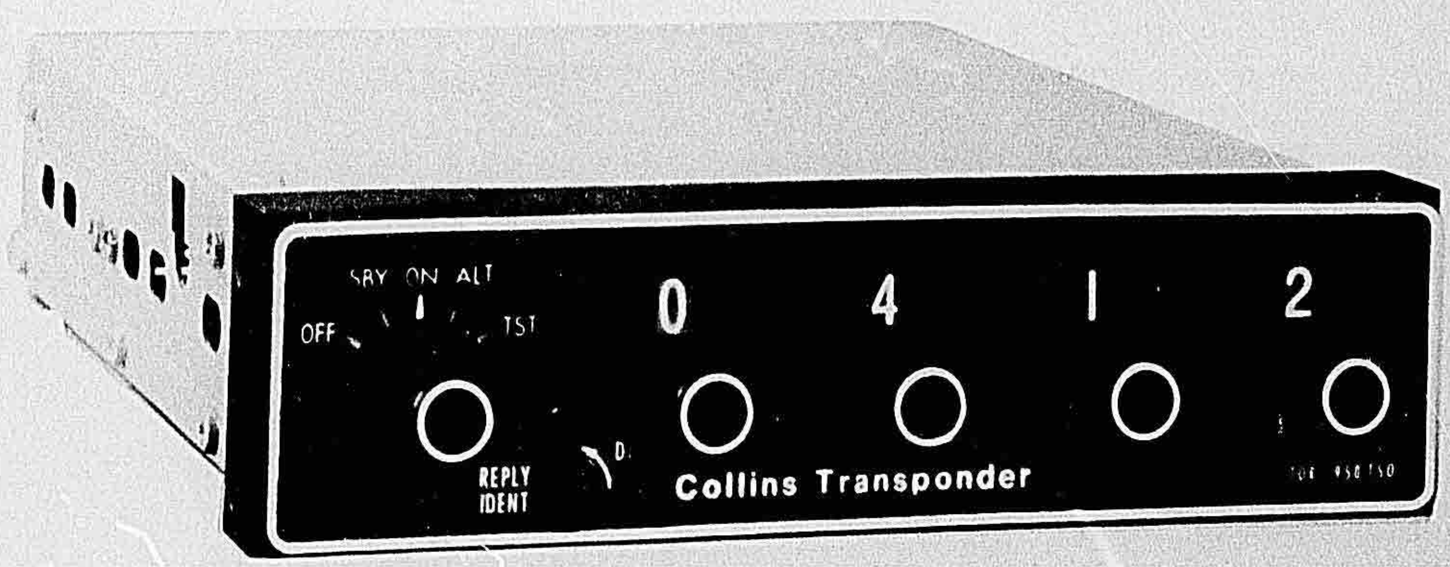
This instruction book contains all the specifications, installation instructions, equipment operating procedures, principles of operation, and information necessary for proper maintenance of the TDR-950/950L Transponder.

1.2 PURPOSE OF EQUIPMENT

The TDR-950 Transponder, Collins part number 622-2092-XXX and TDR-950L, Collins part number 622-3004-XXX are integral parts of the Air Traffic Control Radar Beacon System. The TDR-950/950L provides identification of the transponder-equipped aircraft on the ground controller's plan position indicator. The TDR-950/950L is interrogated by radar pulses from a ground station and automatically replies with a series of pulses. Reply pulses are coded to supply aircraft identification and, when equipped with an altitude digitizer, barometric altitude reporting. Figure 1-1 is an overall view of the TDR-950.

1.3 DESIGN FEATURES

- State-of-the-art design featuring a MOS large-scale integration (LSI) circuit performing all decoding and encoding functions.
- Remote IDENT capability for pilot convenience.
- Response to both mode A and mode C interrogations.
- Altitude digitizer inputs for automatic altitude reporting on mode C.
- Unit self-test to ensure operational readiness.
- Factory installed incoming suppression for maximum flexibility in any installation.
- Internal lighting for maximum visibility and easy reading.
- Mechanical design concepts provide excellent accessibility for maintenance.



TDR-950 Transponder
Figure 1-1

- Front panel mounting.
- Distinctive styling coordinated with other Collins General Aviation Division products.
- Human engineered for maximum visibility and ease of operation.

1.4 EQUIPMENT SPECIFICATIONS

Table 1-1 lists the equipment specifications of the TDR-950/950L Transponders.

1.5 EQUIPMENT SUPPLIED

An installation kit (CPN 628-5612-001) is supplied with the TDR-950/950L Transponder. Figure 2-1, contained in the installation section of this instruction book, details the contents of the kit.

1.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The following equipment, or its equivalent, is required for proper operation of the TDR-950/950L but is not supplied with the unit.

a. Interconnecting cables.
b. 28- to 14-volt power conversion kit (CPN 628-8108-001) when used in a 28-volt system. Refer to figure 2-1 for the contents of the kit.
c. One male BNC connector.

Table 1-1. TDR-950/950L Transponder, Equipment Specifications.

CHARACTERISTICS		SPECIFICATIONS
FAA TSO		
TDR-950		-C74c, class 1A, Environmental category DAPAABEXXXXX DO-138.
TDR-950L		-C74c, class 1B, Environmental category DAPAABEXXXXX DO-138
Dimensions		
Width		159 mm (6.25 in).
Height		41.3 mm (1.625 in).
Length		207 mm (8.15 in).
Mounting depth (behind panel)		
14-V installation		193 mm (760 in) maximum.
28-V installation		215 mm (8.46 in) maximum.
Weight (includes mounting tray)		0.91 kg (2.0 lb).
Panel colors		
TDR-950	TDR-950L	
622-2092-001	622-3004-001	Black.
622-2092-002	622-3004-002	Blue.
622-2092-003	622-3004-003	Green.
622-2092-004	622-3004-004	Red.
622-2092-005	622-3004-005	Brown.
622-2092-006	622-3004-006	Gray.

Table 1-1. TDR-950/950L Transponder, Equipment Specifications (Cont).

CHARACTERISTICS	SPECIFICATIONS
Environmental	
Temperature range	
Continuous	-15 to +55 °C (+5 to +131 °F).
Storage	-40 to +85 °C (-40 to +185 °F).
Altitude	9,144 m (30,000 ft) operating.
Relative humidity	95% at +50 °C (+122 °F).
Shock	
Operational	6 g.
Crash safety	15 g (10 ms duration).
Cooling	Convection.
Electrical	
Power consumption	
Input voltage	+13.75 V dc ±20%.
Input current	0.8 to 1.2A.
Lighting	0.24 A at 14 V rms.
Audio frequency conducted susceptibility	Category A, DO-138.
Audio frequency magnetic field susceptibility	Category A, DO-138.
Radio frequency susceptibility	Category A, DO-138.
Receiver center frequency	1030 MHz.
Bandwidth	
3 dB	±1 MHz minimum.
60 dB	±24 MHz maximum.
Sensitivity (MTL)	-71 to -77 dB mW.
Dynamic range	52 dB minimum.
Random trigger rate	1 per second maximum.
Spurious responses	60 dB down minimum.
Narrow pulse rejection	6 dB minimum at 0.3 μs.
Echo suppression recovery	2.8 ± 0.3 dB per μs.
MTL variation between modes	Less than 1 dB.
Interrogation mode capability	Responds to modes 3/A and C.

Table 1-1. TDR-950/950L Transponder, Equipment Specifications (Cont).

CHARACTERISTICS	SPECIFICATIONS
3-pulse side lobe suppression	
P2 level discrimination (over P1, P3 level from 3 to 50 dB above MTL)	
Less than 1% replies	Less than or equal to 1.0 dB down from P1.
Greater than 90% replies	Greater than or equal to 8.5 dB down from P1.
P1 to P2 pulse spacing tolerance	
Less than 1% replies	1.8 to 2.2 μs (3 to 50 dB above MTL).
Greater than 90% replies	Greater than 2.7 μs or less than 1.3 μs (0 to 50 dB above MTL).
Suppression duration	36 ±2 μs.
Reinitiated suppression duration	34 to 38 μs.
Decoder tolerance (P1 to P3 spacing; over P1, P3 level from 0 to 50 dB above MTL and P2 more than 9 dB above P1).	
Greater than 90% replies	±0.25 μs.
Less than 10% replies	Greater than 0.9 or less than -0.9 μs.
Decoder P1 to P3 amplitude tolerance	±3 dB minimum.
Dead time	34 to 38 μs.
Ident interval	15 to 30 s.
Reply rate control	
Adjustment range	500 to 1200 replies per second.
Factory setting	1200 per second.
Desensitization at 1080 interrogations per s	3 dB maximum.
Desensitization at 1800 interrogations per s	35 dB minimum.
Reply code capability	
Mode A	F1, C1, A1, C2, A2, C4, A4, B1, D1, B2, D2, B4, D4, F2, SPI.
Mode C	F1, C1, A1, C2, A2, C4, A4, B1, B2, B4, D4, F2.
Reply transmission frequency	1090 ±3 MHz.
Transmitter power output	
TDR-950	250 W ±1 dB (peak power at 1% duty or less).
TDR-950L	140 W ±1 dB (peak power at 1% duty or less).

Table 1-1. TDR-950/950L Transponder, Equipment Specifications (Cont).

CHARACTERISTICS	SPECIFICATIONS
Pulse drain power droop	0.7 dB maximum.
Reply delay	2.9 ±0.2 μs.
Delay variation between modes	0.1 μs maximum.
Reply jitter	±0.07 μs maximum.
Reply pulse spacing tolerance	±0.08 μs maximum.
Reply pulse width	0.45 ±0.06 μs.
Reply pulse shape	
Rise time	50 to 100 ns.
Fall time	50 to 200 ns.
Spurious rf emissions	Less than category B DO-138.
Installation limitations	
Antenna cable	
Characteristic impedance	50 ohms.
Maximum loss at 1090 and 1030 MHz	2 dB.
Maximum allowable VSWR	1.2:1 at 1090 MHz.
Antenna VSWR	1.2:1 maximum at 1090 MHz.
Altitude encoder logic levels	
Data bit enabled	Less than 1.0 V dc or less than 1200 ohms to ground.
Data bit inhibited	Greater than 3.0 V dc or greater than 7000 ohms to ground.
Altitude reporting range	-305 m to +19,111 m (-1,000 to 62,700 ft).

Installation

Collins TDR-950/950L Transponder

Rockwell International

installation

Collins General Aviation Division

Printed in USA

523-0766466-005118
5th Edition, 1 August 1984

TDR-950/950L

table of contents

523-0766466-005118

NOTICE: This section replaces fourth edition dated 1 July 1979.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL,
AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	15 Sep 75		None	5th Ed	1 Aug 84	J. L. 12/21/84	All above plus SB 10R1, SIL 2-82
2nd Ed	1Apr 76		SIL 1-75 thru 4-75 1-76, SB 1, 2				
1	1 May 76		Same as above				
2	1 Feb 77		All the above plus SB 3, 4, 5, SIL 2-76 thru 5-76				
3rd Ed	2 Oct 78		All the above plus SB 6, 7, 8; SIL 1-77 thru 3-77 SIL 1-78, 2-78				
4th Ed	1 Jul 79		All the above plus SB 9; SIL 1-79				

AIRCRAFT TECHNICAL PUBLISHERS

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	1 Aug 84
*List of Effective Pages	1 Aug 84
*2-1	1 Aug 84
2-2 Blank	1 Jul 79
2-3	1 Jul 79
2-4 Blank	1 Jul 79
2-5	1 Jul 79
2-6 Blank	1 Jul 79
2-7 thru 2-8	1 Jul 79
*2-9 thru 2-11	1 Aug 84
2-12 Blank	1 Apr 76
2-13	1 Jul 79
2-14 Blank	1 Jul 79
2-15 thru 2-19	1 Jul 79
2-20 Blank	1 Jul 79

section II
installation

2.1 GENERAL

This section contains unpacking and inspection checks, special instructions, installation procedures, and postinstallation testing.

Warning

In the interest of personal safety, it is recommended that the aircraft battery master switch be turned off to disconnect power from the equipment mount before removing or installing any electronic equipment in the aircraft.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Unpack the equipment carefully and make a visual inspection of the unit for possible shipping damage. All claims for damage should be filed with the transportation company involved. If claims for damage are to be filed, save the original shipping carton and materials. If no defects can be detected, replace packing materials in the shipping container and save for future uses such as storage or reshipment.

2.3 SPECIAL INSTRUCTIONS

The following special instructions must be observed to ensure proper installation of the TDR-950/950L Transponder. Damage to the equipment may occur if these instructions are not followed.

a. When inserting the TDR-950/950L in its mounting tray, do not attempt to force the unit into position. If difficulty is experienced, remove the unit and check the position of the twist-lock pawl and rear connector.
b. When the TDR-950/950L is used in a 28-volt system, the 28- to 14-volt power conversion kit, Collins part number 628-8108-001, must be installed. Installation of the kit places a 56-ohm, 15-watt resistor in series with the aircraft light dimmer and a regulating 28- to 14-volt adapter in series with the primary power input line. Note 2 of figures 2-5 and 2-7 provides a partial schematic showing 28-volt interface.

2.4 INSTALLATION

2.4.1 TDR-950/950L Transponder Installation

The following installation procedures must be performed as described to ensure proper operation and performance. Any deviation from these instructions may result in reduced performance and/or damage to the equipment.

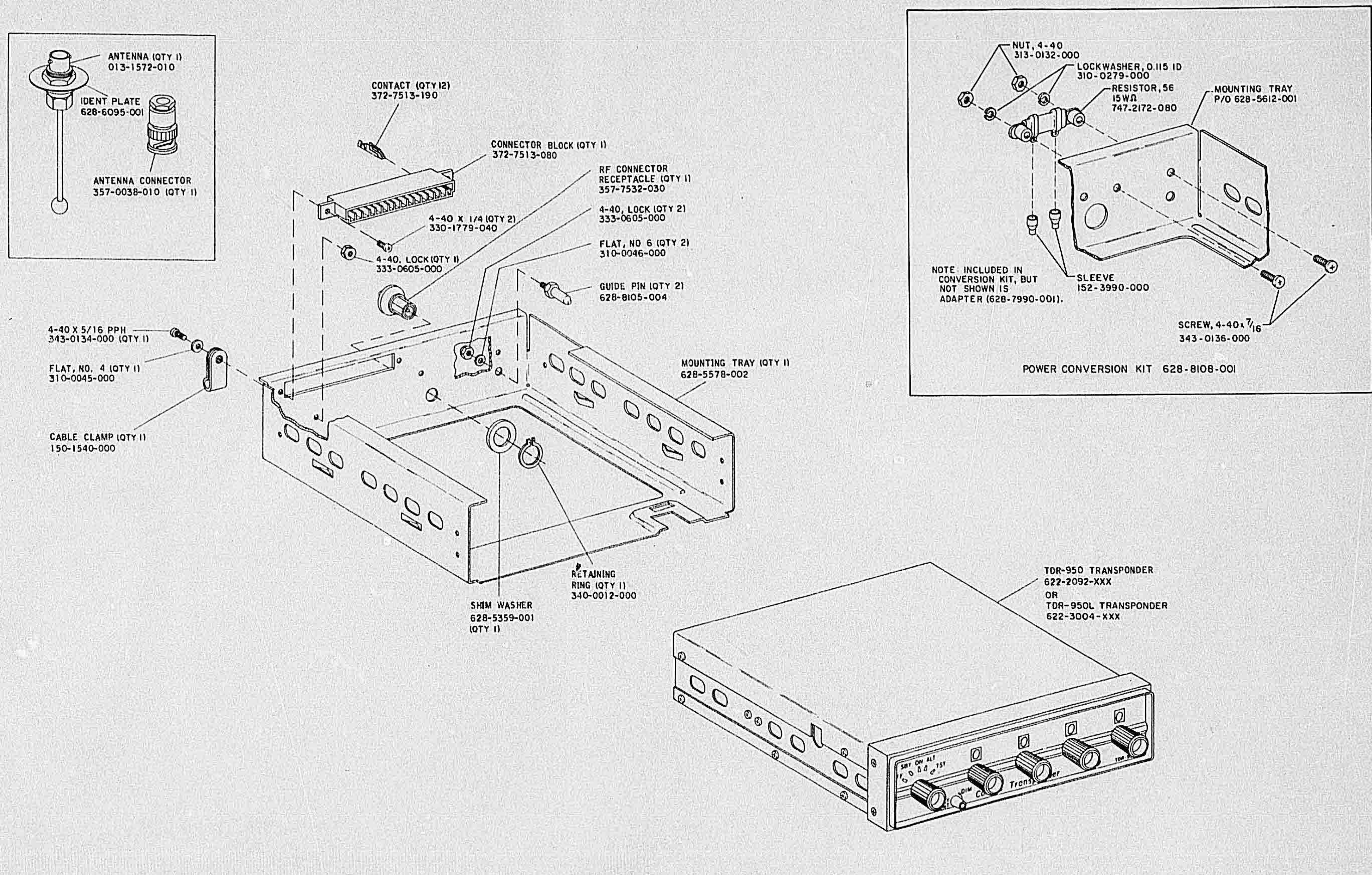
Note

Although not required, cooling air will increase the reliability of the TDR-950/950L Transponder.

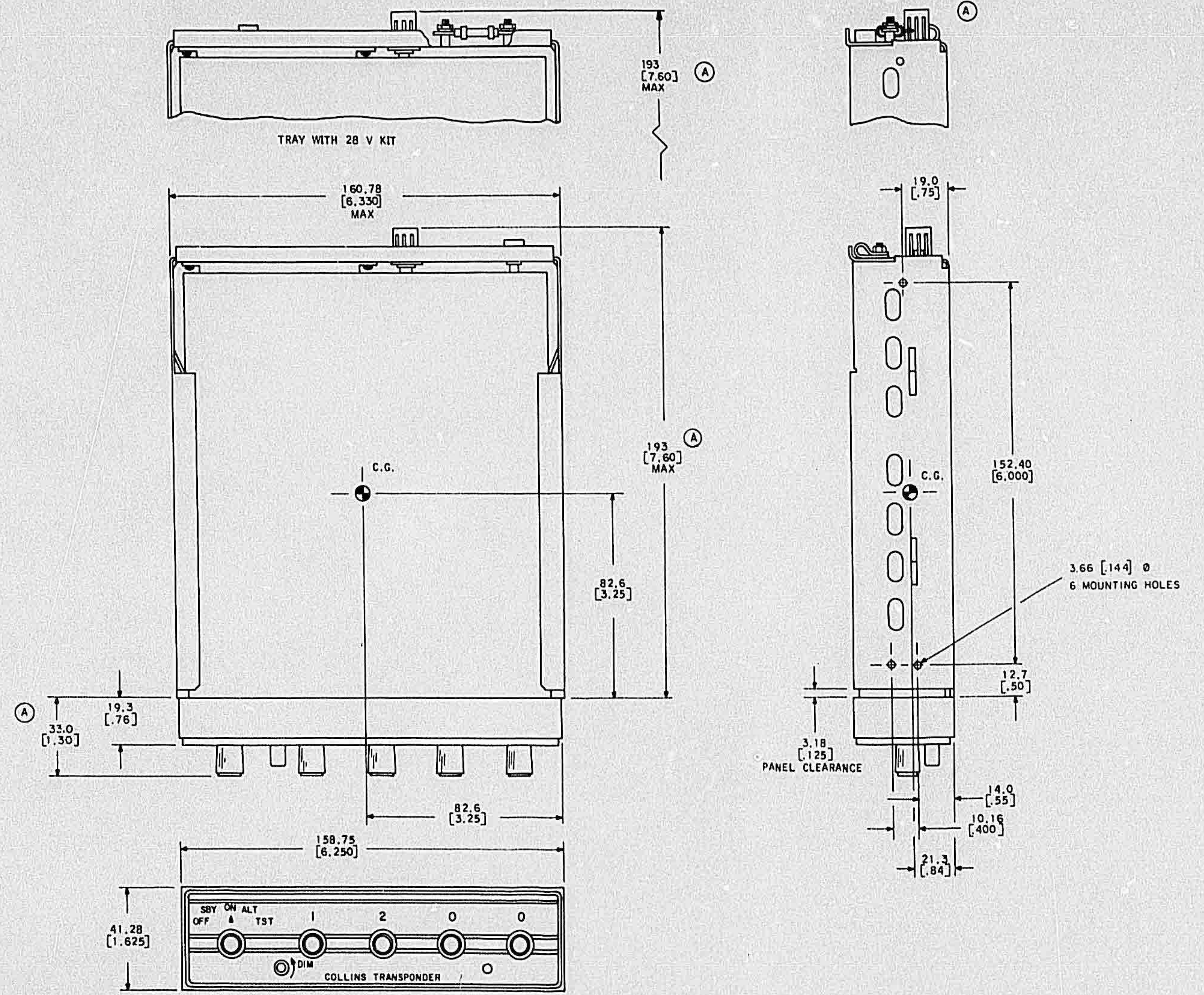
a. The installation kit, Collins part number 628-5612-001, supplied with the TDR-950/950L is required for installation. Refer to figure 2-1. If the TDR-950/950L is to be used in a 28-volt system. The 28- to 14-volt power conversion kit must be used.
b. The TDR-950/950L is rigidly mounted to the aircraft instrument panel. Panel cutout dimensions are provided in figure 2-2. Using the dimensions provided, make the panel cutout and drill the four holes needed to secure the equipment mounting tray to the aircraft panel mounting bracket.
c. Secure the mounting tray in position using four #6 panhead screws. Rear mounting straps are not essential for proper installation; however, mounting holes are provided in case strapping is desired.
d. After the mounting tray has been installed, slide the TDR-950/950L into position and secure in place by tightening the front panel locking screw. Use a 5/64-in Allen wrench. Before insertion, ensure that the front leg of the locking pawl is in the down position.

Caution

Do not force unit into mounting tray. If difficulty is experienced, remove the TDR-950/950L and check rear connector assembly and guide pins for proper installation.

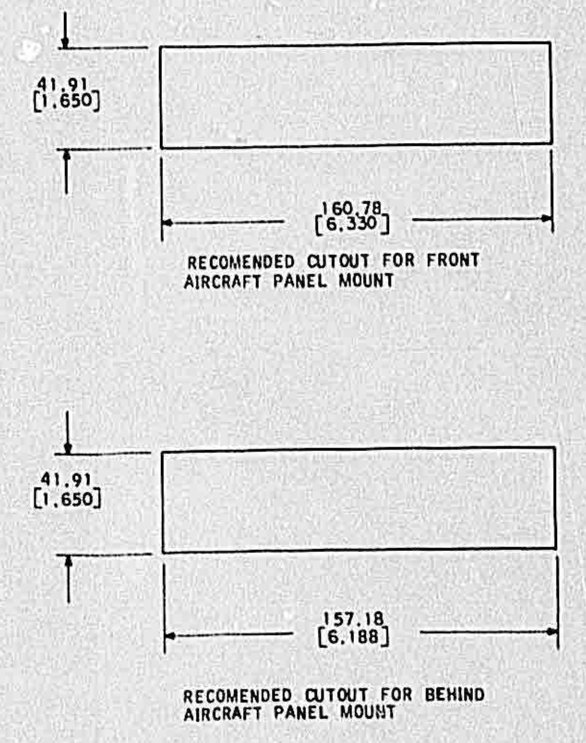


TDR-950/950L Transponder, Installation Kit
Figure 2-1



NOTES:

1. DIMENSIONS ARE IN MILLIMETRES [INCHES].
2. WEIGHT: .91 KILOGRAMS [2.0 POUNDS], (INCLUDING TRAY).
3. USE NO. 6 PAN HEAD SCREWS FOR MOUNTING TRAY.
4. MATING CONNECTORS:
   SIGNAL 372-7513-080
   CONTACTS 372-7513-200
   RF (TRAY) 357-7532-010
   RF (ANTENNA) 357-0038-010



628-6046

TDR-950/950L Transponder, Outline and Mounting Dimensions
Figure 2-2

2.4.2 Transponder Antenna

2.4.2.1 Installation

Placement of the transponder antenna should be carefully planned and installation instructions followed closely to ensure optimum performance of the system. Random placement of the transponder antenna may result in aircraft antenna shielding causing dead spots in normal flight attitudes. Using a nonrecommended coaxial cable type, exceeding the maximum given cable length, or allowing excessively sharp bends in the cable increases transmission line attenuation of the transmitted reply, resulting in reduced power output and a decrease in the effective range. For these reasons, closely adhere to the following steps.

a. For transponder antenna location, select an area well removed from projections such as propellers, landing gear, and engines.
b. Mount the antenna on the bottom surface so that the antenna will be vertical in normal flight attitudes. The surface to which the antenna is attached should be a flat plane having the largest possible area.
c. Ensure good bonding between antenna body and aircraft skin. The inside surface of the aircraft skin must be clean and free of paint and oxidation.

Caution

It is important that adequate isolation be provided between the transponder antenna and a DME antenna to prevent receiver front end damage. It is possible for a transponder to transmit directly on the receiver frequency of a DME, and conversely with the use of DME Y-channels, for the DME to transmit on the receiver frequency of a transponder. Minimum isolation of 40 dB between L-band systems is suggested (this includes antenna isolation plus cable losses). A separation of 1.2 m (4 ft) between L-band stub antennas on a common ground plane provides about 32 dB of isolation. The isolation increases 6 dB each time the separation is doubled; that is, 38 dB for 2.4 m (8 ft), 44 dB for 4.9 m (16 ft), etc.

d. In addition to the preceding caution, it is also recommended that a maximum separation be observed between the ADF sense antenna and the transponder antenna.
e. Refer to figure 2-3 for the transponder antenna outline and mounting dimensions, and drill the required mounting hole as indicated.
f. Position the antenna over the antenna mounting hole and secure in position using the mounting hardware provided.
g. Connect the coaxial cable mating connector with the antenna connector and secure. Any bends in the coaxial cable should have at least a 76-mm (3-in) radius.

2.4.2.2 Antenna Installation Tips

Accumulation of oily film, ice slush, or other foreign material in and around the transponder antenna may cause transmitter frequency pulling. Normally these undesired accumulations occur near the base of the antenna around the recessed Teflon insulator. If the insulator is recessed within a flange at the antenna base, normal aircraft washing may not remove the contamination.

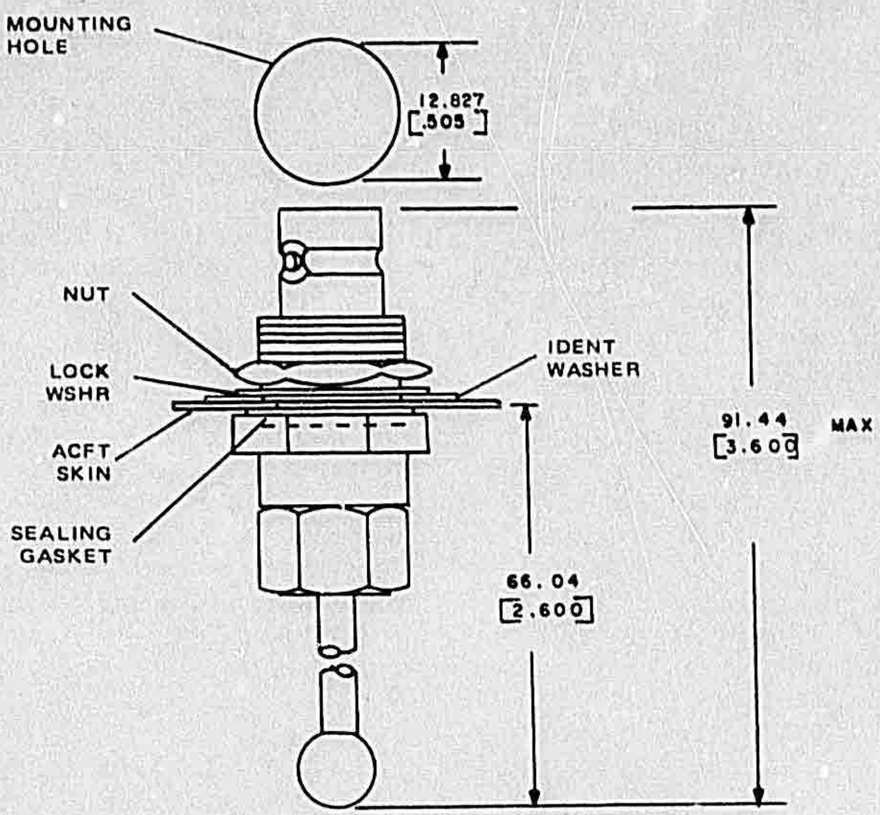
As a preventive measure against contamination buildup in new installations, or when correcting an existing installation, completely fill the flange surrounding the Teflon insulator with RTV-140 or equivalent (be sure to thoroughly clean antennas that have been in actual flight before applying RTV).

After the RTV has cured, use a razor blade to trim away any excess material; the recessed area should be filled flush with RTV. Any excess application that extends beyond the specified area will result in an increase in system vswr; therefore, care should be taken to ensure all excess material has been trimmed away.

Connector corrosion is another problem that is often encountered with many antenna installations. An excellent means of retarding, and in many cases eliminating, corrosion is a liberal application of Dow-Corning DC-4 silicon grease (CPN 005-0201-000) both inside and outside of the connector and its mate. DC-4 will not adversely affect performance in any way; its sole purpose here is to provide an effective barrier against moisture. In addition to transponder antennas, DC-4 is also recommended for use with DME, ADF, vhf, nav, vhf comm, glideslope, marker beacon, and ELT antennas.

2.4.3 28- to 14-Volt Adapter

The following installation procedures must be performed as described to ensure proper operation and performance.



NOTES:
1. DIMENSIONS ARE IN MILLMETERS [INCHES]
2. WEIGHT 28.35 g [1 OZ]
3. CONNECTORS: UG-88/U (CPN 357-0038-010) WITH RG58A/U.
4. REINFORCE MOUNTING AREA WITH DOUBLER PLATE WHERE REQUIRED.

628-6448
TP4-4279-012

TDR-950/950L Transponder Antenna, Outline and Mounting Dimensions
Figure 2-3

a. Avoid mounting the adapter close to temperature-sensitive equipment.
b. Rigidly mount the adapter to the airframe. Mounting may be in any convenient location or position where adequate air circulation is available. Use four #6 panhead screws and flat washers to secure the adapter in place.
c. Refer to figure 2-4 for adapter outline and mounting dimensions.

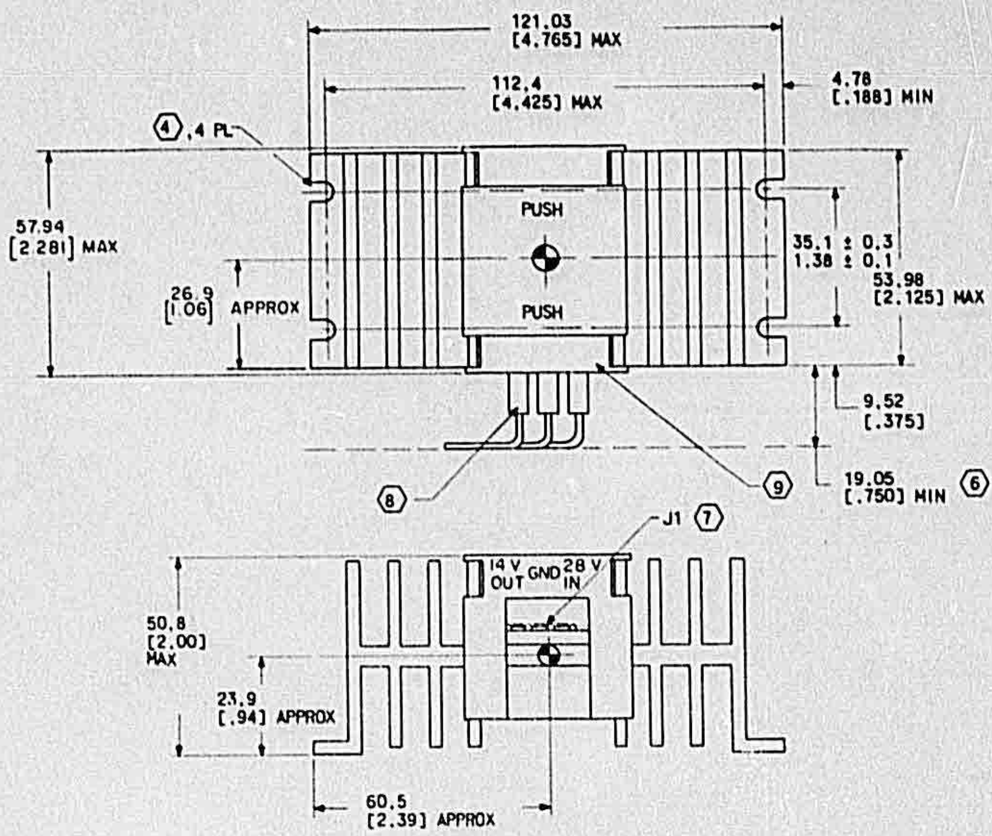
2.5 CABLING

Figure 2-5 is an interconnect wiring diagram for a single TDR-950/950L Transponder and Altitude Digitizer. Figure 2-6 lists the TDR-950/950L mating connector (tray mounted connector) pin functions and shows their locations within the connector. Figure 2-7 is the interconnect wiring harness for a TDR-950/950L installed without the AED-950 Altitude Encoding Digitizer. Finally, figure 2-8 illustrates the interconnect wiring diagram for a dual TDR-950/950L installation and includes altitude reporting equipment.

2.5.1 Wiring Precautions

During preparation of the interconnect wiring cables, observe the following precautions:

a. Bond and shield all parts of the aircraft electrical system, such as generator and ignition systems.
b. Keep the interconnect cables away from heavy-current circuits, pulse transmitting equipment, and sources of interference.

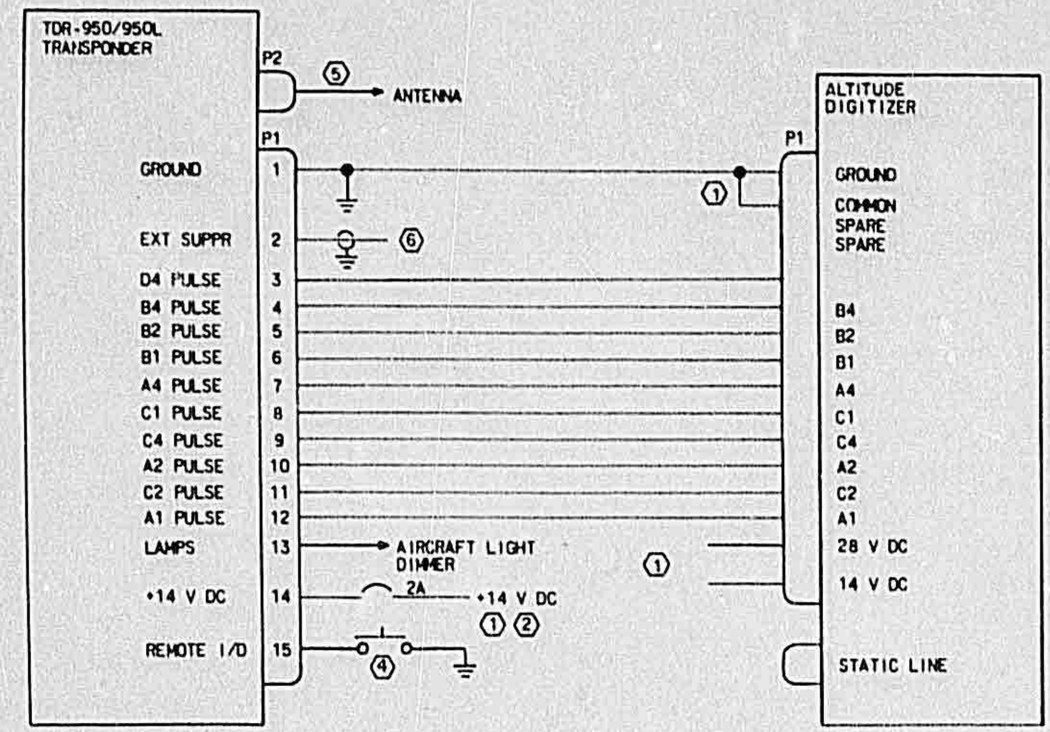


NOTES:

1. DIMENSIONS ARE IN MILLIMETERS [INCHES].
2. WEIGHT: 0.22 KG [.48 LB]
3. THIS DRAWING APPLIES TO 628-7990-001
4. SLOTS PROVIDED FOR MOUNTING UNIT. USE NO. 6 PAN HEAD SCREW AND FLAT WASHER (NOT SUPPLIED).
5. DENOTES CENTER OF GRAVITY.
6. RECOMMENDED CLEARANCE FOR TERMINALS AND WIRES.
7. UNIT CONNECTOR J1 IS A TRW/CINCH 172 SERIES BARRIER BLOCK 351-27-03-001 (CPN 367-1887-020).
8. TERMINALS FOR UNIT CONNECTOR J1, SUPPLIED WITH UNIT, ARE TYPED 320773 FOR 22-16 AWG WIRE AND NO. 2 STUD MANUFACTURED BY AMP INCORPORATED (CPN 304-1551-020). USE AMP INC. CRIMP TOOL NO. 47386 (CPN 304-8003-020).
9. UNIT COVER MUST BE REMOVED TO INSTALL TERMINALS ON J1 CONNECTOR. WHEN INSTALLING COVER PRESS WITH FINGER IN AREA NOTED ON COVER (2) TWO PLACES UNTIL SNAP LOCK IS FELT.

628-8072

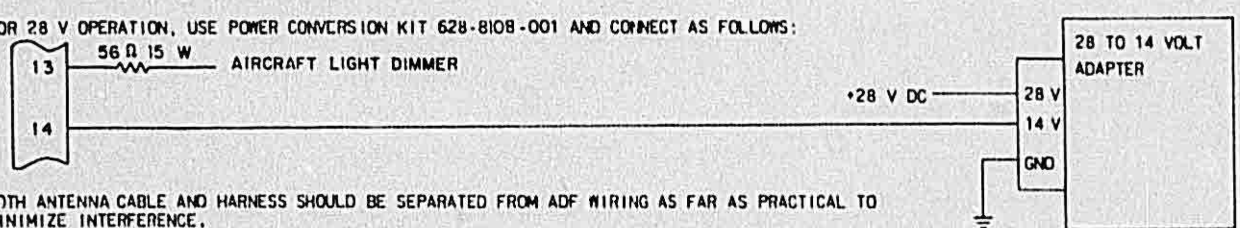
28- to 14-Volt Adapter, (included in Power Conversion Kit 628-8108-001), Outline and Mounting Dimensions
Figure 2-4



NOTES:

1. WIRES CARRYING 14/28 V DC (INCLUDING POWER GROUND) MUST BE 22 AWG OR LARGER; ALL OTHER WIRES MUST BE 24 AWG OR LARGER.

2. FOR 28 V OPERATION, USE POWER CONVERSION KIT 628-8108-001 AND CONNECT AS FOLLOWS:



3. BOTH ANTENNA CABLE AND HARNESS SHOULD BE SEPARATED FROM ADF WIRING AS FAR AS PRACTICAL TO MINIMIZE INTERFERENCE.

4. REMOTE IDENT IS OPTIONAL.

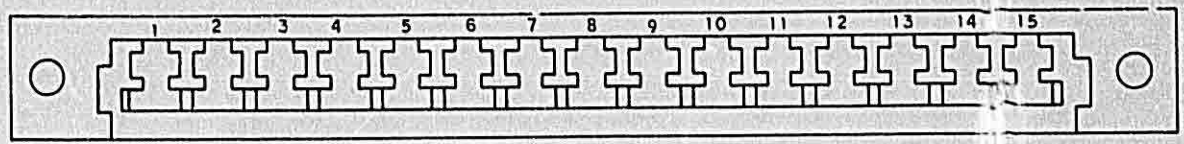
5. DO NOT LACE ANTENNA CABLE INTO WIRING BUNDLE.

6. USE OF SUPPRESSION IS OPTIONAL IN ALL INSTALLATIONS. REFER TO SERVICE BULLETINS 1 AND 9. USE SHIELDED WIRE.

7. IF D4 OR A1 IS NOT INCLUDED IN DIGITIZER, LEAVE RESPECTIVE TRANSPONDER CONNECTIONS OPEN. IF D4 CONNECTION IS OPEN, ALTITUDE REPORTING WILL BE LIMITED TO 31,000 FT. IF D4 AND A1 CONNECTIONS ARE LEFT OPEN, ALTITUDE REPORTING WILL BE LIMITED TO 15,000 FT.

628-8035

TDR-950/950L Transponder and Altitude Digitizer, Interconnect Wiring Diagram
Figure 2-5

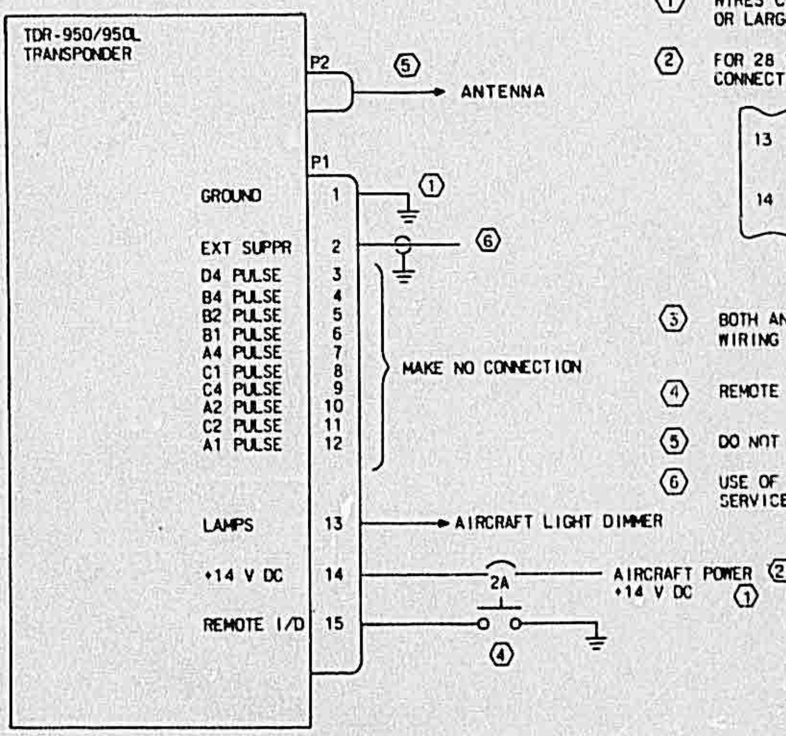


COLLINS PART NUMBER 372-7513-080
MOLEX PART NUMBER 09-01-2151

PIN	FUNCTION	PIN	FUNCTION
1	GROUND	8	C1
2	EXT SUPPR	9	C4
3	D4	10	A2
4	B4	11	C2
5	B2	12	A1
6	B1	13	LAMPS
7	A4	14	+14 V DC
		15	RMT I/D

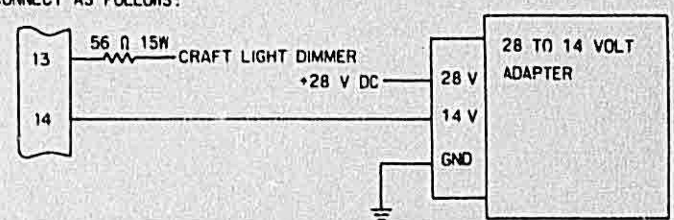
628-8057

TDR-950/950L Transponder, Mating Connector Pin Assignments
Figure 2-6



NOTES:

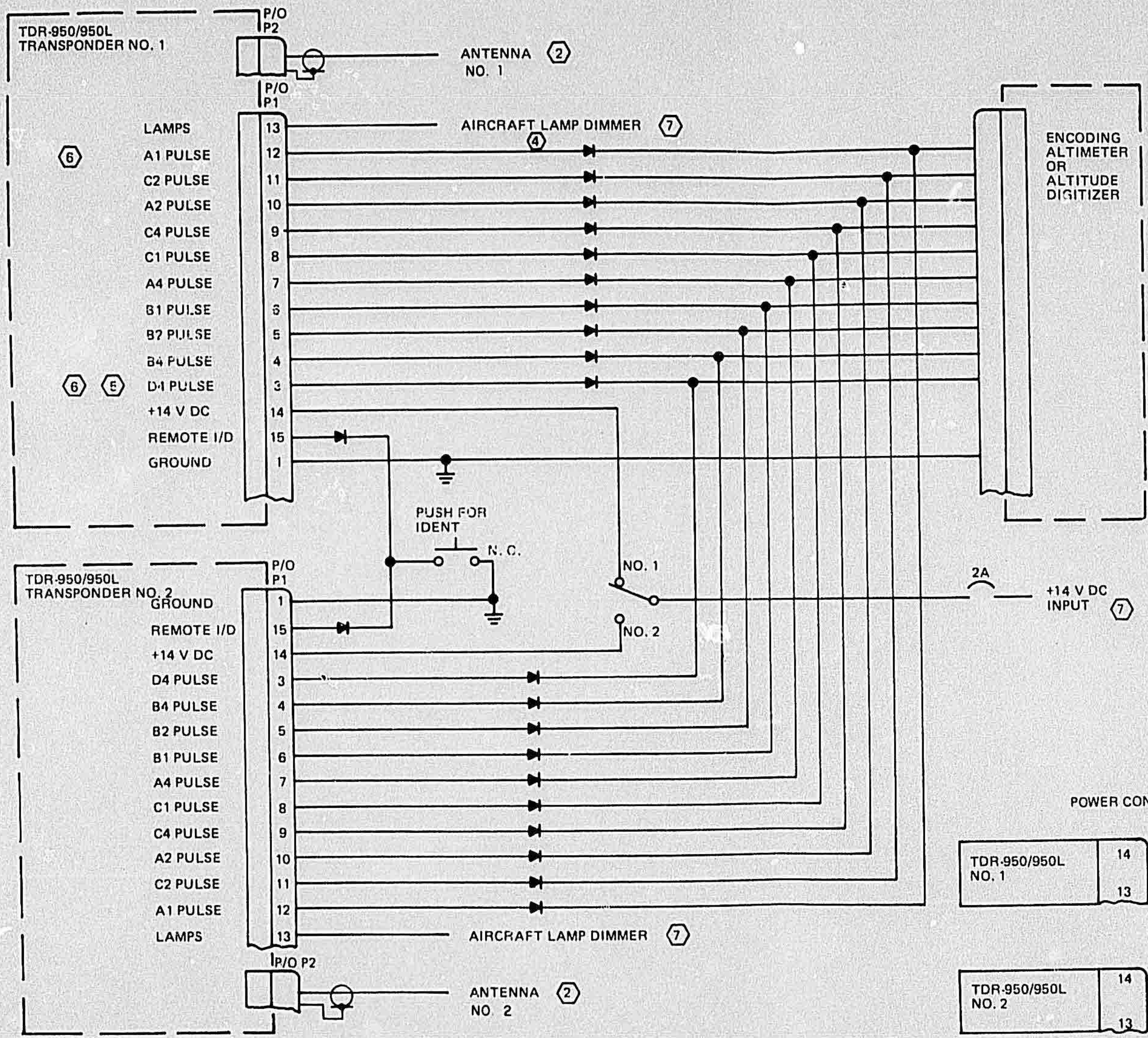
1. WIRES CARRYING 14/28 V DC (INCLUDING POWER GROUND) MUST BE 22 AWG OR LARGER; ALL OTHER WIRES MUST BE 24 AWG OR LARGER.
2. FOR 28 V OPERATION, USE POWER CONVERSION KIT 628-8108-001 AND CONNECT AS FOLLOWS:



3. BOTH ANTENNA CABLE AND HARNESS SHOULD BE SEPARATED FROM ADF WIRING AS FAR AS PRACTICAL TO MINIMIZE INTERFERENCE.
4. REMOTE IDENT IS OPTIONAL.
5. DO NOT LACE ANTENNA CABLE INTO HARNESS BUNDLE.
6. USE OF SUPPRESSION IS OPTIONAL IN ALL INSTALLATIONS. REFER TO SERVICE BULLETINS 1 AND 9. USE SHIELDED WIRE.

628-5942

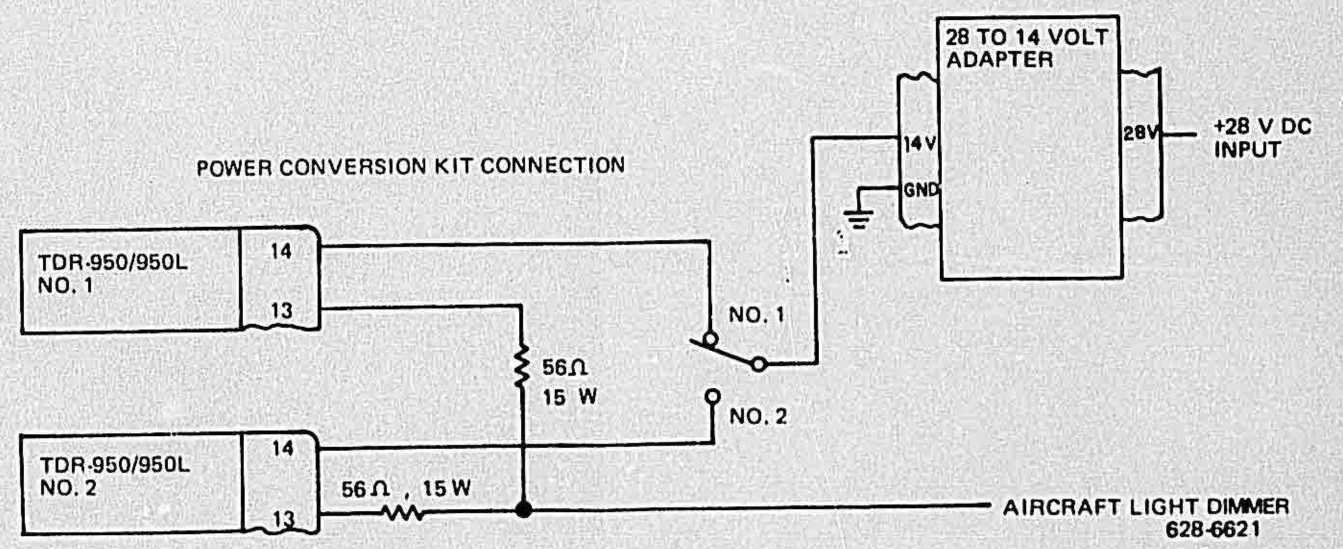
TDR-950/950L Interconnect Wiring Diagram Without Altitude Digitizer
Figure 2-7



NOTES:

1. WIRES CARRYING 14/28 V DC (INCLUDING POWER GROUND) MUST BE 22 AWG OR LARGER; ALL OTHERS MUST BE 24 AWG OR LARGER.
2. DO NOT LACE ANTENNA COAX INTO HARNESS BUNDLE. CABLE SHOULD BE LOCATED AS FAR AWAY FROM HARNESS AS POSSIBLE.
3. BOTH ANTENNA CABLE AND HARNESS SHOULD BE SEPARATED FROM ADF WIRING AS FAR AS PRACTICAL TO MINIMIZE INTERFERENCE.
4. ALL DIODES ARE TYPE 1N4454 (CPN 353-3741-010).
5. IF D4 CONNECTION IS LEFT OPEN, ALTITUDE REPORTING WILL BE LIMITED TO 31,000 FEET.
6. IF D4 AND A1 CONNECTIONS ARE LEFT OPEN, ALTITUDE REPORTING WILL BE LIMITED TO 15,000 FEET.
7. FOR 28 V OPERATION USE POWER CONVERSION KIT (CPN 628-8108-001) AND CONNECT AS SHOWN BELOW.

POWER CONVERSION KIT CONNECTION



TDR-950/950L Dual Installation, Interconnect Wiring Diagram
Figure 2-8

c. Leave slack in the cable to allow for movement due to vibration.
d. After installation of the cables in the aircraft and before installation of the equipment, a check should be made to ensure that the aircraft power is applied only to the pins specified.

2.5.2 TDR-950/950L Connector Installation and Removal

Remove and install mating connector contacts in accordance with steps a and b. Table 2-1 lists the special tools required to perform the following steps.

a. The connecting wire must be crimped in the contact so that the crimped portion of the contact can enter the connector shell and provide a positive lock of the contact in the shell. Use either of the crimping tools listed in table 2-1 and crimp each interconnect wire in a contact. Insert each contact in the proper connector shell hole and press in until locked. To ensure contact is locked securely, pull back lightly on wire.
b. To remove a contact, use the extraction tool to unlock the contact and pull the contact out of the connector shell from the rear.

2.5.3 Antenna Cabling

a. Refer to figure 2-9 for installation of the TDR-950/950L antenna tray connector. Figure 2-10 illustrates the method of preparing and installing the cable connector used at the antenna end of the transmission line. Coaxial cable type number and maximum cable lengths are provided in figure 2-11.
b. The antenna cable configurations shown in figure 2-11 should accommodate most installations; however, if a greater cable length is required, a low-loss coaxial cable must be selected. Cable attenuation must not exceed 2 dB.

2.5.4 28- to 14-V Adapter Cabling

a. All connections to the adapter are made through the terminal block located on the side of the unit.
b. When preparing the wiring harness, use an AMP crimping tool (AMP No 47836, CPN 304-8003-020) to fasten the harness wires to the terminals provided with the adapter.
c. When fastening the wiring harness to the adapter terminal board, use the unit cover labeling as a guide in selecting the correct input and output terminals.

2.6 POSTINSTALLATION CHECKS

2.6.1 Self-Test

The following postinstallation checks are to be performed with the TDR-950/950L and its associated equipment installed in the aircraft. Checks should be made using the aircraft power supply.

a. Energize the TDR-950/950L system by turning the necessary aircraft circuit breakers on and positioning the function selector switch to ON. The TDR-950/950L has a built-in, 20-second delay from the time the primary power is applied until the unit is in the operate condition.
b. Turn and hold the function selector switch to the test (TST) position. If the TDR-950/950L is functioning properly, the REPLY lamp will light and remain on as long as the function selector switch is held in the TST position.

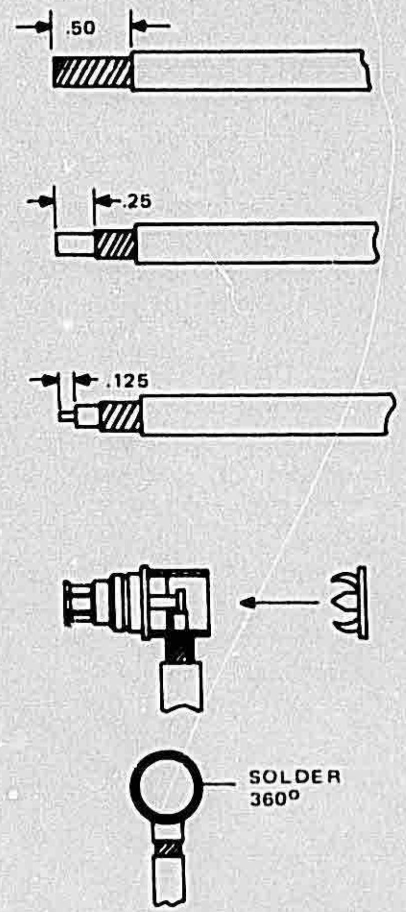
2.6.2 Ramp Test

2.6.2.1 General

After the equipment has been mounted in the aircraft and all cabling has been installed, make the operational checks outlined below. These tests may be

Table 2-1. Special Tools.

DESCRIPTION	MANUFACTURER AND TYPE	COLLINS PART NUMBER
Crimping tool	Ratchet type: MOLEX, 11-01-0008	372-0065-010
	Pliers type: MOLEX, 11-01-0015	372-0065-020
Extraction tool	MOLEX, 11-03-0004	372-0065-030



TRIM COAX OUTER INSULATION BACK 0.5" AS SHOWN.

TRIM BRAID BACK 0.25". DO NOT UNRAVEL.

STRIP DIELECTRIC BACK 0.125".

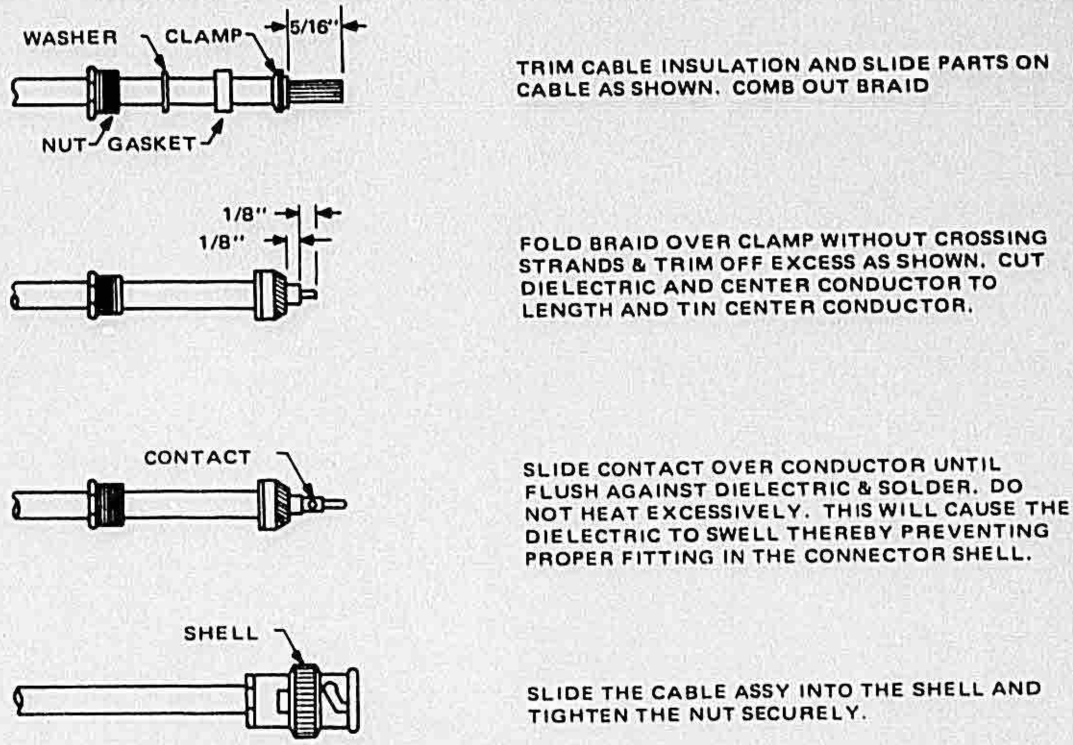
INSERT CABLE THROUGH SIDE WALL OF CONNECTOR AND SOLDER CENTER CONDUCTOR TO CENTER PIN OF CONNECTOR. HEAT THE OUTSIDE OF THE CONNECTOR SLEEVE AND AT THE SAME TIME APPLY SOLDER BETWEEN BRAID AND SLEEVE. CONTINUE TO APPLY HEAT UNTIL THE SOLDER FLOWS EVENLY. INSERT CONNECTOR CAP INTO END OF FITTING AND SOLDER 360° AROUND.

357-7532-030 RF CONNECTOR

NOTE: CLOSE ADHERANCE TO THIS PROCEDURE IS NECESSARY FOR AN INTERFERENCE FREE INSTALLATION.

628-6509
TP4-7801-011

Installation of 357-7532-030 Antenna Connector, Transponder End
Figure 2-9



Installation of Antenna Connector, Antenna End
Figure 2-10

made using the aircraft power supply with the engine running, or with auxiliary power applied to the aircraft.

2.6.2.2 Test Equipment Required

The test equipment required for the ramp test is listed in table 2-2. The ramp test set listed in table 2-2 is a representative type only; an equivalent unit may be substituted.

Table 2-2. Ramp Test Equipment Required.

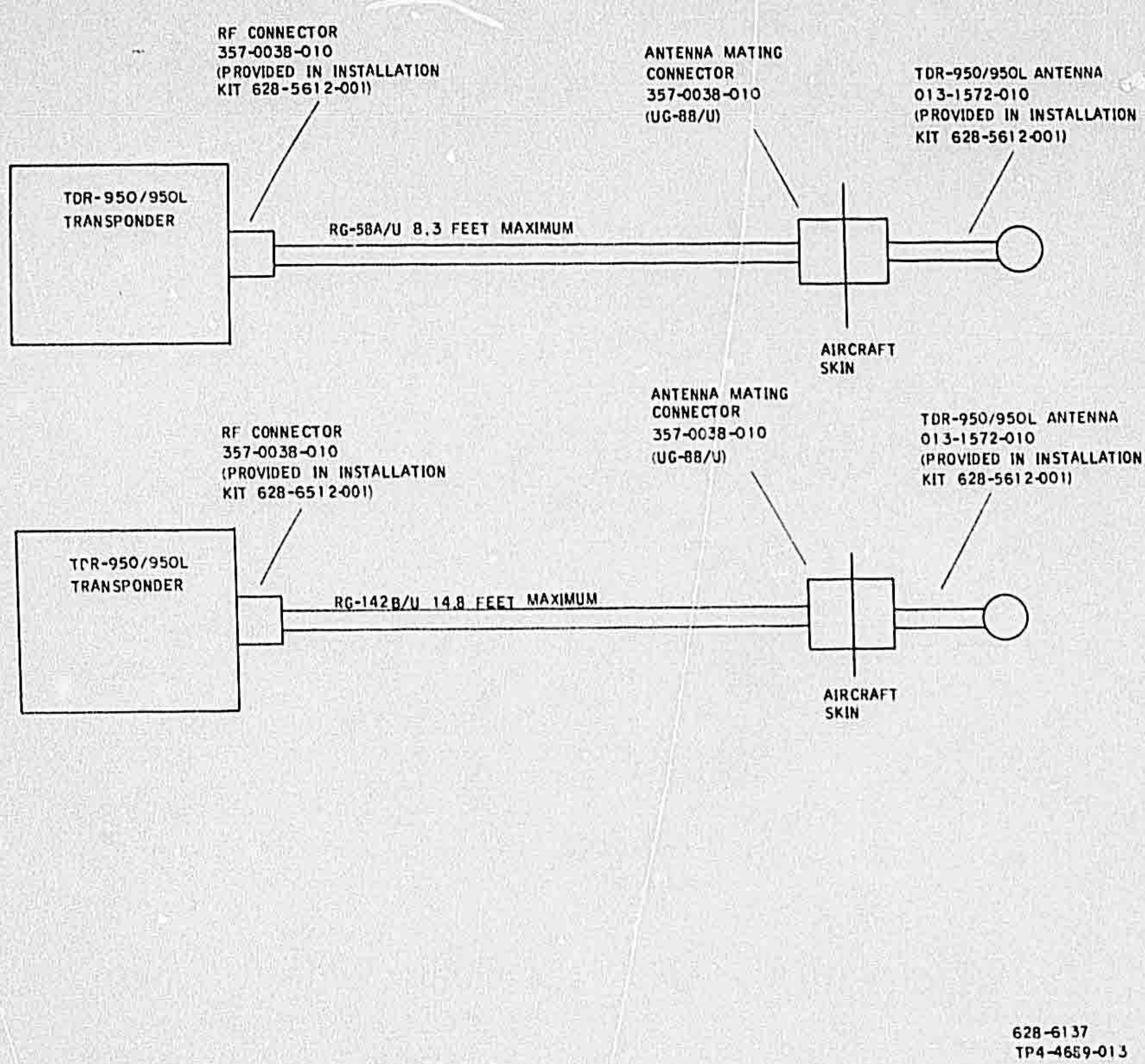
DESCRIPTION	REPRESENTATIVE TYPE
Ramp test set	Collins 476X-3 ATC Transponder Ramp Test Set (Collins part number 522-4475-001)

2.6.2.3 Ramp Test Procedures

a. If the 476X-3 ATC Transponder Ramp Test Set is to be used for testing the TDR-950/950L Transponder, perform the preoperational check of the 476X-3 as described in paragraph 3.3.1 of the 476X-3 instruction book (Collins part number 523-0783700). If an equivalent ramp test set is to be used, perform a preoperational check on that unit to ensure proper operation prior to testing the TDR-950/950L.
b. Disconnect 476X-3 T/R DIRECT connector P504 from rf connector J503. Connect antenna connector P503 to rf connector J503.
c. Locate the 476X-3 in relation to the aircraft and set the T/R ATTEN control as determined in paragraph 3.2.3 of the 476X-3 instruction book.

Note

Ensure that the 476X-3 open top cover is facing the aircraft antenna.



Antenna Cable Configurations
Figure 2-11

d. Set the 476X-3 CODE selector switches to any code other than emergency codes (7777, 7700, or 7600).

e. Set the TDR-950/950L code selector switches to the same code as that set on the 476X-3.

f. Turn the TDR-950/950L function selector switch to the STBY position and allow at least 20 seconds for the unit to warm up.

g. Set the 476X-3 MODE selector to mode A. The MODE A flag will appear.

h. Turn the TDR-950/950L function selector switch to ON. At this time the 476X-3 CODE flag should appear.

Note

If the aircraft does not have a source of digitized altitude information, skip steps i through k and proceed with step l.

i. Turn the TDR-950/950L function selector switch to ALT and the 476X-3 CODE selector to the code corresponding to field elevation. (Use the calculator provided with the 476X-3 to convert from altitude to code.)

j. Set the 476X-3 MODE selector to mode C. The MODE C and CODE flags should appear.

k. Set the TDR-950/950L function selector switch to the SBY position. The 476X-3 CODE flag should disappear.

l. Set the 476X-3 MODE selector to mode A and the CODE selector to the complement of the test code on the 476X-3. Turn the TDR-950/950L function selector switch to ON.

Note

To find the complement of the test code, subtract the test code from 7777.

m. The 476X-3 CODE flag should now be in view.

n. Momentarily depress the IDENT button on the TDR-950/950L. Both the CODE and IDENT flag should blink for approximately 15 to 30 seconds.

o. If correct results are obtained in steps i through n, the TDR-950/950L is operating properly.

Rockwell International

Collins TDR-950/950L Transponder

operation

Collins General Aviation Division

Printed in USA

523-0766467-002118
2nd Edition, 1 April 1976

table of contents

NOTICE: This section replaces first edition dated 15 September 1975.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	15 Sep 75		None				
2nd Ed	1 Apr 76		1-75 thru 4-75, 1-76, SB1, 2				
		S. L. 12/21/84	All those above plus SB3, 4, 5 SIL 2-76 thru 5-76				

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

section III
operation

3.1 GENERAL

This section presents an operating description, basic flight application, and operating procedures for the TDR-950/950L Transponder.

The TDR-950/950L is an integral part of the air traffic control radar beacon system. The TDR-950/950L provides identification of the transponder-equipped aircraft on the ATC ground controller's plan position indicator. When used with an altitude digitizer, the TDR-950/950L provides the ATC ground controller with the pressure altitude of the aircraft.

When interrogated by valid radar pulses received from the ground station, the TDR-950/950L will reply automatically with a series of pulses. Reply pulses are coded to provide a unique identification of the aircraft. When the aircraft is also equipped with an altitude digitizer, automatic altitude reporting will be included in response to mode C interrogations.

3.2 DISPLAYS AND CONTROLS

Refer to figure 3-1 for illustration and identification of the controls and indicators discussed in this section. Table 3-1 briefly discusses the function of each listed item.

3.2.1 Function Selector

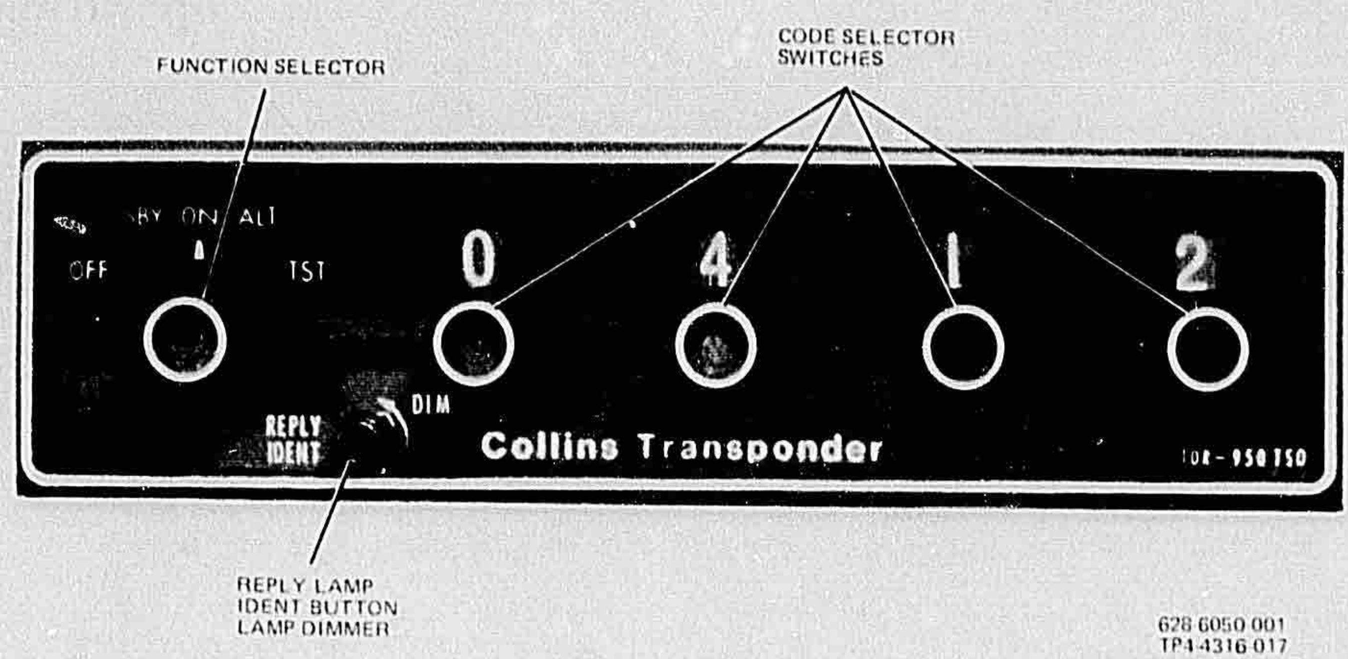
The function selector controls the application of primary power to the unit and the mode of operation of the TDR-950/950L. There is a 20-second delay from the time primary power is applied (function selector in any position other than OFF) until operation of the TDR-950/950L is obtained. This 20-second delay allows the transponder transmitter tube time to warm up and stabilize. Selection of the ON or ALT position enables the transponder, causing it to become an active part of the beacon system. Reception of a valid interrogation in either of these two modes initiates generation of the reply pulse train. In the ON position, the configuration of the reply pulse train is determined by the unit front panel code selector switches and the mode of the interrogating signal. Mode A interrogations initiate the generation of the complete panel code selected pulse train; mode C interrogation (function selector switch in ON position) results in the transmission of F1 and F2 framing pulses only.

Note

> Ordinarily when flying VFR, code 1200 should be selected for flight below, or climbing to, 10,000 feet or above until leaving 9,-500 feet mean sea level. At this time, code 1400 should be selected and used for all altitudes at or above 10,000 feet. When descending, code 1200 should be selected upon passage through 10,000 feet MSL. Other reply codes for normal operation may be requested at the option of ATC.
>
> If loss of vhf transceiver communication is experienced, the pilot should set the function selector switch to ON and select code 7700 for a period of 1 minute. After the 1-minute duration, code 7600 should be selected for a period of 15 minutes or the remainder of the flight, whichever comes first.
>
> Under no circumstances should civil aircraft operate on code 0000. This particular code is reserved for military interceptor operations. When operating in restricted or warning areas the transponder should be set to code 4000 unless otherwise specified by ATC.

When the TDR-950/950L is used in conjunction with an encoding altimeter and the ALT position is selected, the pressure altitude of the aircraft will be transmitted to ATC upon reception of a valid mode C interrogation. If the aircraft is not equipped with an encoding altimeter, framing pulses only will be transmitted in response to a mode C interrogation.

Selection of the SBY position maintains application of unit primary power; however, responses to any interrogations are inhibited. The SBY position is normally selected during taxiing operations.



TDR-950/950L Transponder, Controls and Indicators
Figure 3-1

Table 3-1. TDR-950/950L Transponder, Controls and Indicators

CONTROL OR INDICATOR	FUNCTION
Function selector	Selects transponder mode of operation: unit off, standby, on, altitude, or test.
REPLY lamp	Lamp flashes each time a response is made to a valid interrogation. The REPLY lamp will remain on for approximately 20 seconds after releasing the IDENT button; this signifies transmission of the SPIP. Selection of the TST position lights the REPLY lamp if the TDR-950/950L is operational.
IDENT button	Momentarily depressing the IDENT button adds a SPIP to the normal reply pulses for aircraft identification.
Lamp dimmer	Rotation of the IDENT button sets the brightness of the REPLY lamp.
Code selector switches	Establish the mode A identification reply code.

The TST position provides a means to check operational readiness of the TDR-950/950L. The self-test feature is a confidence check on the unit and provides a valid indication of the operating condition. The TST position is spring loaded and therefore must be held in place to accomplish testing. If the TDR-950/950L is operating properly, selection of the TST position will cause the REPLY lamp to illuminate.

3.2.2 REPLY Lamp

The reply lamp will light whenever a response is made to a valid interrogation, the IDENT button is depressed, or the TST position is selected.

When responses are made to interrogations, the REPLY lamp will flash on and off; depressing the

IDENT button or selection of the TST position places the REPLY lamp steadily on.

3.2.3 IDENT Button

When the IDENT button is depressed, an additional SPIP (special position identification pulse) is added to the normal reply pulses resulting in a unique identification pattern display on the ATC radar scope. This SPIP is transmitted for approximately 20 seconds longer than the time during which the IDENT button is depressed. The IDENT button is depressed only when ATC requests the aircraft to "squawk ident." The REPLY lamp serves as an IDENT transmission monitor by remaining solidly on for the period of SPIP transmission.

3.2.4 Lamp Dimmer

Dimming of the REPLY lamp is accomplished by turning the IDENT button. This allows the pilot to maintain an optimum REPLY lamp brightness for any cockpit ambient lighting condition.

3.2.5 Code Selector Switches

The reply code, which is displayed in the code windows, is selected by rotating the code selector switches. The switches are a rotary type, each having eight positions with no end stops. The 4-digit code selected will determine the configuration of the reply pulse train.

3.3 OPERATING PROCEDURES

Energize the TDR-950/950L system by turning on the necessary aircraft circuit breakers and positioning the function selector switch to the SBY position. Allow a minimum of 20 seconds for transmitter tube warmup, then select the TST position. If the REPLY lamp becomes illuminated, the TDR-950/950L is operational. Return the function selector switch to SBY while on the ground.

The customary in-flight mode of operation is ON unless the TDR-950/950L is used in conjunction with an altitude digitizer. In this case, ALT should be selected for in-flight operation. Selection of the ALT position results in the transmission of pressure altitude to air traffic control.

When requested by ATC to "squawk ident," the IDENT button should be depressed and momentarily held. This action initiates the generation of the SPIP used by ATC to identify the squawking aircraft.

In a high-density area, ATC may request in-flight standby operation of the transponder after aircraft identification. This prevents the ground radar from being saturated with replies from too many aircraft. In-flight operation in the SBY mode should be used only when requested by ATC.

3.4 TRANSPONDER PHRASEOLOGY

Air traffic controllers will use the phraseology listed in table 3-2 when referring to operation in the air traffic control radar beacon system (ATCRBS). Instructions directed to the pilot by air traffic control refer to operation on mode A and mode C only.

Table 3-2. Transponder Phraseology.

TERM	INTERPRETATION
IDENT	Initiate transponder special position identification pulse by depressing IDENT button.
SQUAWK (number)	Operate transponder on designated code with function selector switch in ON or ALT position.
SQUAWK ALTITUDE	Set transponder function selector switch to ALT (mode C). Applicable to aircraft with encoding altimeter only.
SQUAWK (number) AND IDENT	Set transponder to specified code with function selector switch in ON or ALT position and engage IDENT button.
SQUAWK MAYDAY	Turn function selector to ON or ALT and select code 7700.
SQUAWK STANDBY	Switch transponder function selector switch to SBY.
STOP ALTITUDE SQUAWK	Turn transponder function selector switch from ALT (mode C) to ON (mode A).
STOP SQUAWK	Turn transponder function switch to SBY.

Collins TDR-950/950L Transponder

Rockwell International

theory

Collins General Aviation Division

Printed in USA

523-0766468-004118
4th Edition, 1 August 1984

table of contents

NOTICE: This section replaces third edition dated 2 October 1978.

Collins TDR-950/950L Transponder

Rockwell International

theory

Collins General Aviation Division

Printed in USA

523-0766468-004118
4th Edition, 1 August 1984

table of contents

523-0766468-004118

2

NOTICE: This section replaces third edition dated 2 October 1978.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	15 Sep 75		None				
2nd Ed	1 Apr 76		SIL 1-75 thru 4-75, SIL 1-76 SB 1, 2				
3rd Ed	2 Oct 78		Those above plus SB 3, 4, 5, 6, 7, 8; SIL 2-76 thru 5-76; SIL 1-77 thru 3-77; SIL 1-78, 2-78				
4th Ed	1 Aug 84	S. L. 12/21/84	SB 9,10 SIL 1-79, 2-82				

AIRCRAFT TECHNICAL PUBLISHERS

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID
9/82						

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	1 Aug 84
*List of Effective Pages	1 Aug 84
4-1 thru 4-2	1 Apr 76
4-3	15 Sep 75
4-4 thru 4-5	1 Apr 76
4-6	2 Oct 78
4-7 thru 4-9	1 Apr 76
4-10 Blank	15 Sep 75
4-11 thru 4-12	2 Oct 78
4-13	15 Sep 75
4-14 thru 4-28	2 Oct 78
*4-29 thru 4-30	1 Aug 84

section IV

theory

4.1 GENERAL

The TDR-950/950L Transponder is an integral part of the Air Traffic Control Radar Beacon System (ATCRBS). The TDR-950/950L replies to all valid ATC radar interrogations with a coded reply signal. The reply signal is used by air traffic control to locate and identify the transponder-equipped aircraft. The TDR-950/950L transmits on a frequency of 1090 MHz and receives on a frequency of 1030 MHz. Included in the TDR-950/950L is a side-lobe suppression (sls) circuit that discriminates against side-lobe radiation emitted by the secondary surveillance radar (SSR).

The purpose of this section is to describe the basic ATC radar beacon system and explain in detail the role of the TDR-950/950L Transponder in that system.

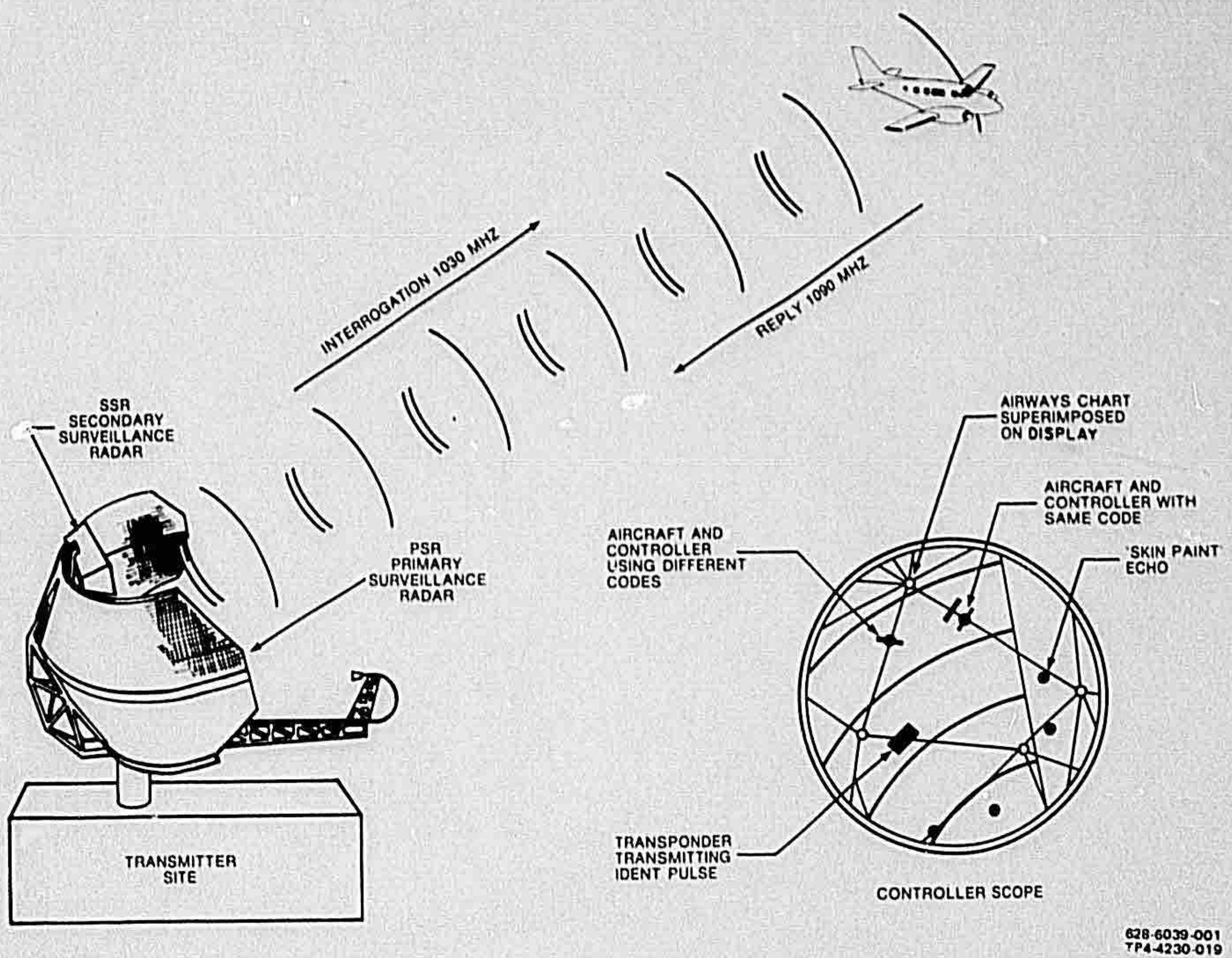
Table 4-1 is a list of abbreviations and symbols used in association with the TDR-950/950L and transponders in general.

Table 4-1. Definition of Terms.

TERM	DEFINITION
CW level between pulses	At least 60 dB below peak pulse level.
Desensitization pulse (DP)	A single pulse, 0.8 μs wide as measured at the raw video point, used for the purpose of measuring echo suppression characteristics.
Echo	An invalid interrogation received in conjunction with, and usually of a lesser amplitude than, a valid interrogation.
Fall time	Time measured from the 90- to the 10-percent amplitude point on the trailing edge of a pulse.
Identification pulse (SPIP)	Serves to identify the aircraft at the request of the aircraft traffic controller. The pulse appears 24.65 μs after the first framing pulse.
Interrogation rate	The number of interrogations per second generated by the SSR.
Interrogation signal level	Peak power of interrogation signal measured at P2 connector expressed in dB below one milliwatt.
Minimum triggering level (MTL)	The lowest signal level of a standard main-lobe interrogation measured at the transponder antenna connector, required to maintain a 90-percent reply efficiency. MTL shall be determined by subtracting the cable loss from the signal generator attenuator reading.
Primary surveillance radar (PSR)	Used for location and tracking of all aircraft in the control area.
Pulse spacing	Time measured between the 50-percent amplitude points on the leading edges of two designated pulses, unless otherwise specified.
Pulse width	Time measured between the 50-percent amplitude points on the leading and trailing edges of a single pulse.
Receiver frequency	1030 ±0.1 MHz.

Table 4-1. Definition of Terms (Cont).

TERM	DEFINITION
Reply efficiency	The reply rate divided by the interrogation rate expressed as a percentage.
Reply rate	The number of reply pulse groups transmitted per second.
Rise time	Time measured from the 10- to the 90-percent point on the leading edge of a pulse.
Side-lobe interrogation	
Pulse spacing	Pulse designated P2, spaced 2.0 ±0.1 μs following P1.
Signal level	3 to 50 dB above MTL, with P1 = P3 ±1 dB, P2 variable from 0 to +2 dB with respect to P1 and P3.
Signal level range	0 to 50 dB above MTL with P1 = P3 ±1 dB.
Side-lobe suppression (sls)	Prevents triggering by the side-lobe radiation emitted by the secondary surveillance radar.
Secondary surveillance radar (SSR)	Used to identify transponder equipped aircraft by transmitting signals and receiving coded replies. SSR is scan synchronized with PSR.
Standard interrogation	
Rise time	Between 0.05 and 0.1 μs.
Fall time	Between 0.05 and 0.2 μs.
Pulse width	0.8 ±0.1 μs; P2 level 9 dB or more below P1.
Main-lobe pulse spacing (between two pulses designated P1 and P3)	
Mode A	8.0 ±0.1 μs.
Mode C	21.0 ±0.1 μs.
Reply frequency	1090 ±3 MHz.



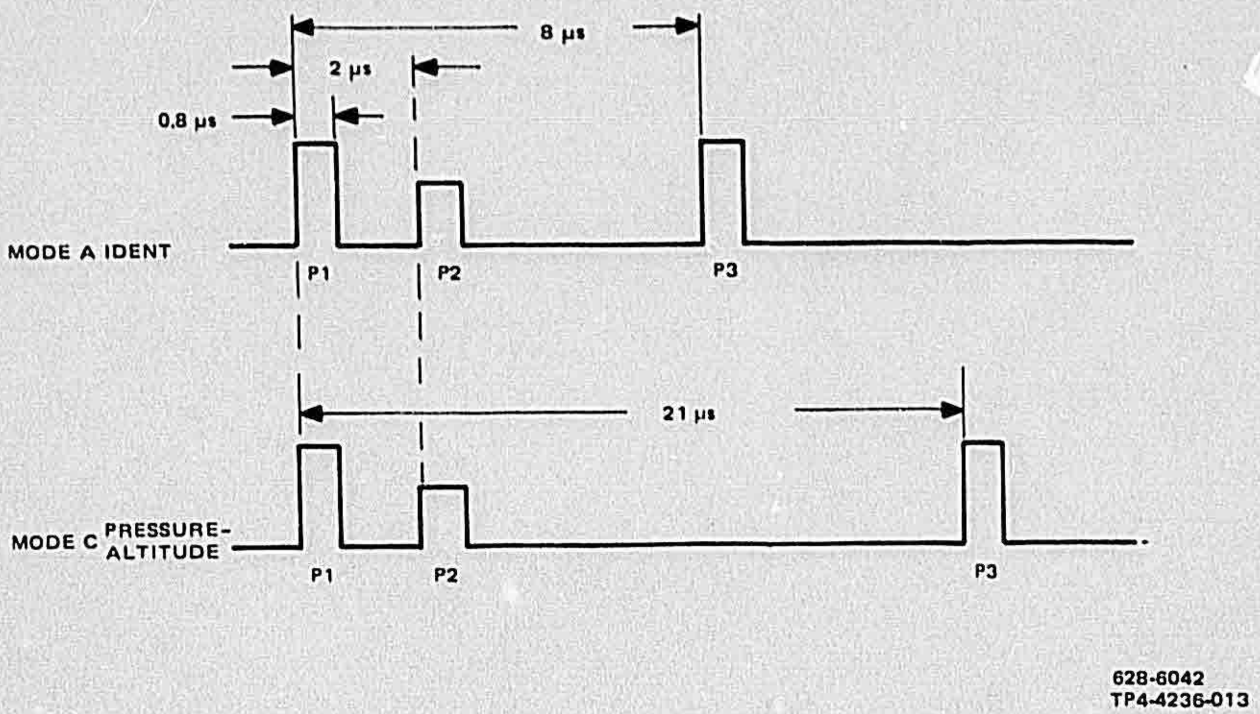
Air Traffic Control Radar Beacon System
Figure 4-1

4.2 ATC SYSTEM DESCRIPTION

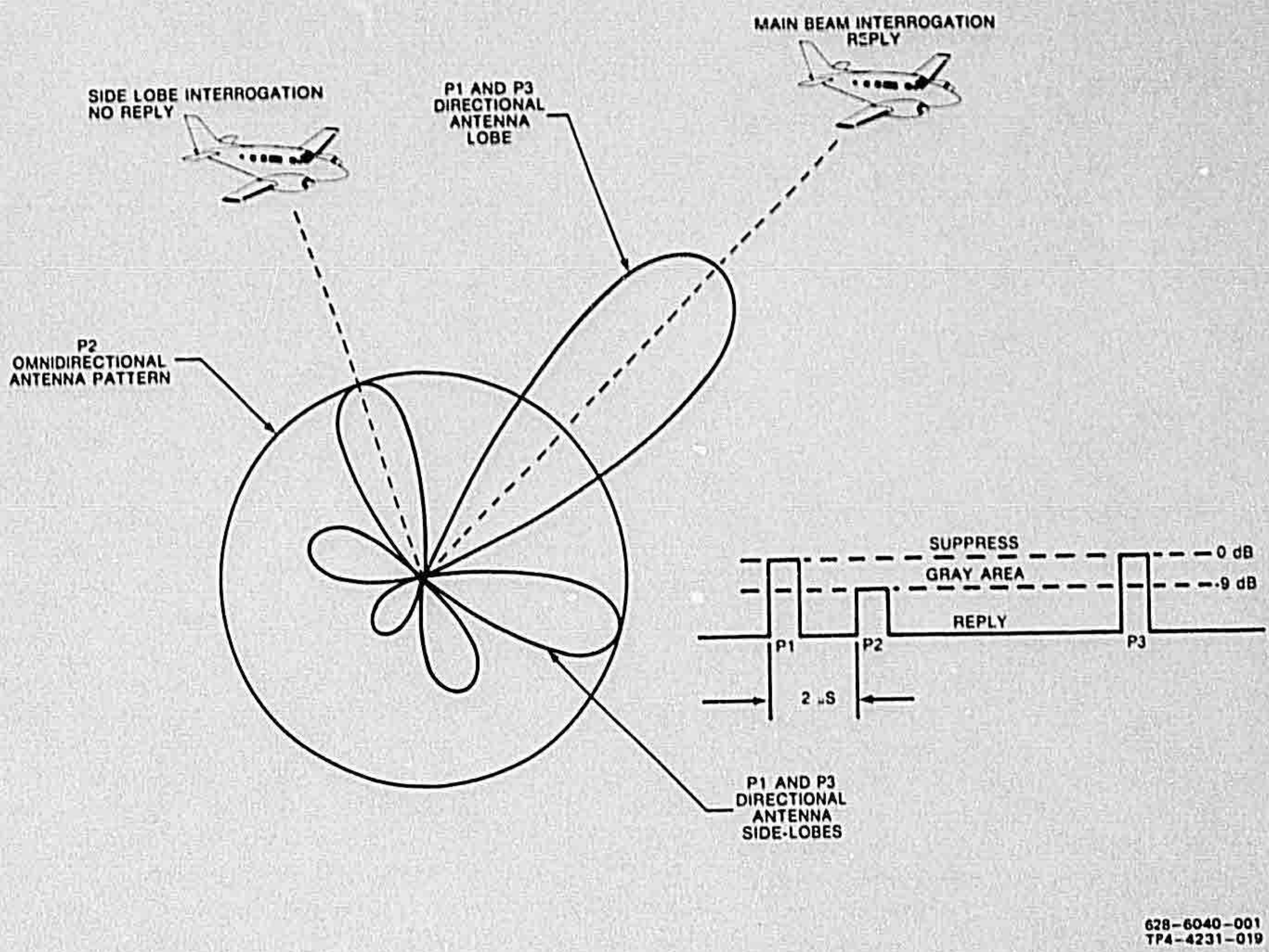
4.2.1 Ground Station Equipment (Refer to figure 4-1.)

Several types of surveillance radars are used in the ATC system. Of these, only the primary surveillance radar (PSR) and secondary surveillance radar (SSR) are functionally related to transponders.

The PSR is used to locate and track all aircraft within the control area. The SSR, scan synchronized with the PSR, is used to identify transponder-equipped aircraft by transmitting interrogation signals and receiving the coded replies. Data from the PSR and SSR are used in conjunction to develop the total air traffic situation and display it on the controller's radarscope. This enables the controller to identify transponder-equipped aircraft in addition to determining range and direction of all aircraft within the control area.



3-Pulse Interrogation
Figure 4-2

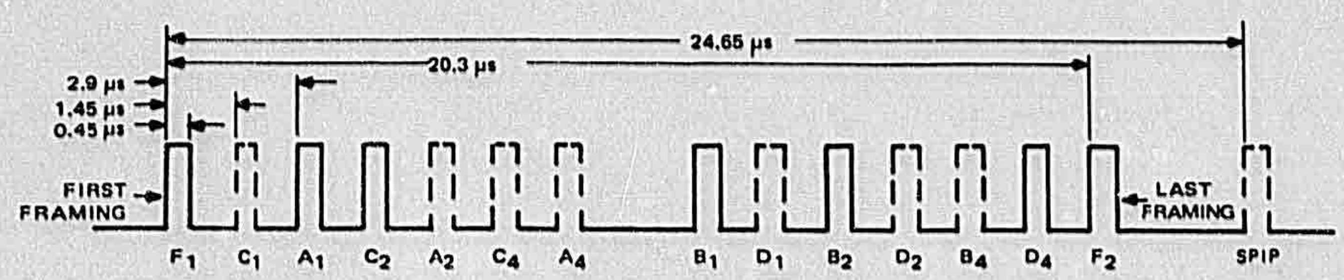


Propagation of 3-Pulse Interrogation Signal
Figure 4-3

4.2.2 Ground Station Interrogation (Refer to figures 4-2 and 4-3.)

Currently in the United States there are two types of interrogations, mode A and mode C, that may be transmitted by an ATCRBS ground station (figure 4-2). Each interrogation is distinct from the other and is characterized by the spacing of the P3 pulse from the P1 pulse. The TDR-950/950L is interrogated by this 3-pulse sls method and operates on modes A and C.

The 3-pulse sls method of interrogation utilizes a directional antenna that transmits a pair of pulses referred to as P1 and P3 pulses (figure 4-3). As previously stated, the time spacing between these pulses determines the mode of operation. Two microseconds after the P1 pulse is transmitted from the directional antenna, the second pulse, P2, is transmitted from the omnidirectional antenna. The P2 pulse is used as a reference pulse for sls determination. The signal strength of the omnidirectional pulse, P2, is just sufficient to provide coverage over the area in which side lobes pose a problem. Side-lobe interrogation is recognized by the TDR-950/950L when omnidirectional pulse P2 is equal to or stronger than directional pulse P1. When this condition exists, no reply will be generated. Identification of a side-lobe interrogation is established before the second interrogation pulse P3 is received. Therefore the TDR-950/950L will be inhibited for a period lasting 35 microseconds, regardless of the interrogation mode. A valid main-lobe interrogation is recognized when the P1 pulse is at least 9 dB larger than the omnidirectional pulse P2. Reception of a valid main-lobe interrogation results in the generation of a reply by the TDR-950/950L.



Position of Reply Code Pulses
Figure 4-4

4.2.3 TDR-950/950L Reply Signals (Refer to figure 4-4.)

Reply signals are generated by the TDR-950/950L when an interrogation signal is determined as valid. The coded reply signal is composed of a series of pulses on a carrier of 1090 ±3 MHz. The number of pulses generated in a reply signal is determined by the code selected on the TDR-950/950L front panel or the altitude data supplied from an altitude digitizer such as the AED-950 or from an encoding altimeter. An identification pulse is also available and, when generated, is transmitted 4.35 microseconds after the last framing pulse. Regardless of the mode of operation, the two framing pulses are always present in the coded reply signal and are spaced 20.3 microseconds apart.

The coded reply signal consists of various arrangements of code pulses within the boundaries formed by the framing pulses, F1 and F2. Each code is assigned a specific pulse arrangement. The reply code is divided into four pulse groups: A, B, C, and D. Each group contains three pulses that are assigned subscripts that indicate the binary weight of each. For example, the pulse arrangement in figure 4-4 is assigned reply code 1324. The first digit (1) consists of the A1 pulse (=1); the second digit (3), the B1 + B2 pulses (=3); the third digit (2), the C2 pulse (=2); and the fourth digit (4), the D4 pulse (=4).

The special position identification pulse (SPIP), initiated upon request of ATC, is generated by momentarily depressing the IDENT button located on the TDR-950/950L front panel. The SPIP causes a special effect on the ground radarscope that aids ATC in determining aircraft position. This pulse occurs 4.35 microseconds after the last framing pulse F2 and is transmitted with each mode A reply for 15 to 30 seconds after releasing the IDENT button.

4.2.4 ATC Radarscope Presentation

Received radar video and antenna azimuth information signals are relayed from the radar site to the air traffic control center, where the signals are processed and displayed on radarscopes. Since radar coverage of each site includes a large area, several controllers are assigned to various segments of the area covered. Each controller's segment of the area is displayed on his respective radarscope. The incoming radar video signals are applied to a decoder control before being displayed. By adjusting the decoder to pass only a selected code, transponders operating on the controller's code will appear as a short arc on the radarscope and as a bright (bloomed) arc when transmitting an identification pulse. Replies from transponders not transmitting the selected code will be filtered out. "Skin-paint" echoes detected by the primary surveillance radar will be displayed on the radarscope for all aircraft.

4.3 TDR-950/950L FUNCTIONAL THEORY OF OPERATION (Refer to figure 4-5.)

4.3.1 Low-Pass Filter and Preselector

Pulse-modulated, 1030-MHz signals from the ground station are received by the antenna and applied through the low-pass filter and diplexer to a 3-pole preselector that routes the received signal to the receiver. The preselector passes the interrogation signal and rejects other frequencies, particularly the transponder transmit frequency, 1090 MHz, and the band of frequencies used for DME transmission. The diplexer allows one antenna to be used for both transmitting and receiving. The low-pass filter attenuates harmonics of the transponder reply transmission.

4.3.2 Local Oscillator and Mixer

The crystal controlled local oscillator operates at a fundamental frequency of 136.25 MHz. Its output is doubled and then quadrupled to produce the 1090-MHz injection signal to the mixer. The mixer, coupled to the last resonator of the preselector, combines the oscillator injection frequency with the received signal to produce an IF output of 60 MHz.

4.3.3 Intermediate Frequency Amplifier

The IF amplifier provides amplification and video detection of the signal from the mixer. The gain of the IF amplifier is controlled in two different and independent ways. One method of control is derived from the detector that provides negative feedback voltage as a function of received signal strength; a logarithmic output is obtained using this method. The other is provided by the reply rate limiting circuitry that controls the IF gain as a function of the number of replies generated per second. Exceeding 1080 replies per second reduces IF gain, reducing sensitivity.

4.3.4 Ditch Comparator and Pulse Width Discriminator

The positive pulse train supplied by the detector is applied to the ditch comparator circuit where this signal and the ditch signal are amplitude compared. The digger circuit produces a linearly decaying voltage behind the P1 pulse into which the P2 pulse is introduced. When the main-lobe interrogation signal is received, the P2 pulse will be smaller than the P1 pulse and will not appear in the comparator output. When interrogated by a side lobe, P2 will appear larger than P1 and will be present in the output.

Whether an output of the comparator reaches the large-scale integration (LSI) decoder-encoder is also a function of the pulse width discriminator. The pulse width discriminator monitors the input to the ditch comparator and prevents an output from occurring for pulses less than 0.3 microsecond wide. Pulses 0.4 microsecond or wider will produce an output.

4.3.5 Decoder-Encoder

The LSI device performs the functions of both decoder and encoder. The decoder function determines validity and mode of the interrogation signal. If the interrogation pulse spacing identifies a mode, the LSI device will begin generating the encoder pulse train. If the pulse spacing does not conform to a particular mode, no further processing will occur within the LSI device.

Side-lobe interrogation is also recognized by the LSI device by detection of the P2 pulse. The P2 pulse will not be present at the input to the LSI device when interrogated by the main lobe; suppression of P2 under these conditions is a function of the ditch circuit. When a valid interrogation is received, the LSI device provides an output which initiates the generation of a reply pulse train. The reply code sequence is determined by the interrogating mode and the code set on the front panel controls or the altitude digitizer inputs.

A decoder clock generator and an encoder clock generator are required to facilitate LSI device operation, as are inputs from the front panel control and altitude digitizer. The decoder clock generator is crystal controlled and operates at 3.0 MHz. The encoder clock generator operates at 690 kHz and is actuated by the LSI device. The clock pulses from both generators are applied to shift registers within the LSI device that perform the decoding and encoding functions.

When an interrogation signal is determined valid, the LSI device enables the encoder clock generator that applies timing pulses to a one-shot multivibrator contained in the modulator section. The multivibrator drives the modulator that pulses the transmitter. The transmitter will be turned on whenever a modulation pulse occurs. Reply pulse spacing is controlled by the encoder clock generator; the reply pulse pattern is controlled by the LSI device encoder.

4.3.6 Modulator and Transmitter

When triggered by the encoder clock generator and enabled by the encoder, the modulator will produce the pulses required to drive the transmitter. When driven by the modulator, the transmitter will produce an rf reply pulse train at 1090 MHz that is sent through the low-pass filter to the antenna. The transmitter is a cathode-pulsed, single-tube, L-band oscillator.

4.3.7 Reply Rate Limiter

For each reply, the LSI produces a 34-microsecond, positive-going pulse that is applied to the reply rate limiter. The reply rate limiter averages these pulses and causes a decrease in IF gain when the rate of reply exceeds 1080 per second.

The 34-microsecond reply pulse is also processed and used to activate the lamp driver which turns on the REPLY lamp. The REPLY lamp will be illuminated each time the transponder replies to an interrogation.

4.3.8 Special Position Identification Pulse

Upon request of ATC a special position identification pulse (SPIP) must be initiated. This is accomplished by momentarily depressing the IDENT button on the TDR-950/950L front panel. This action initiates the generation of the SPIP that will accompany each reply for a period of 22 seconds. Depressing the IDENT button places the I/D input to the decoder-encoder low (logic 0) for a 22-second duration determined by an RC network. During this time the REPLY lamp on the unit front panel will remain steadily illuminated.

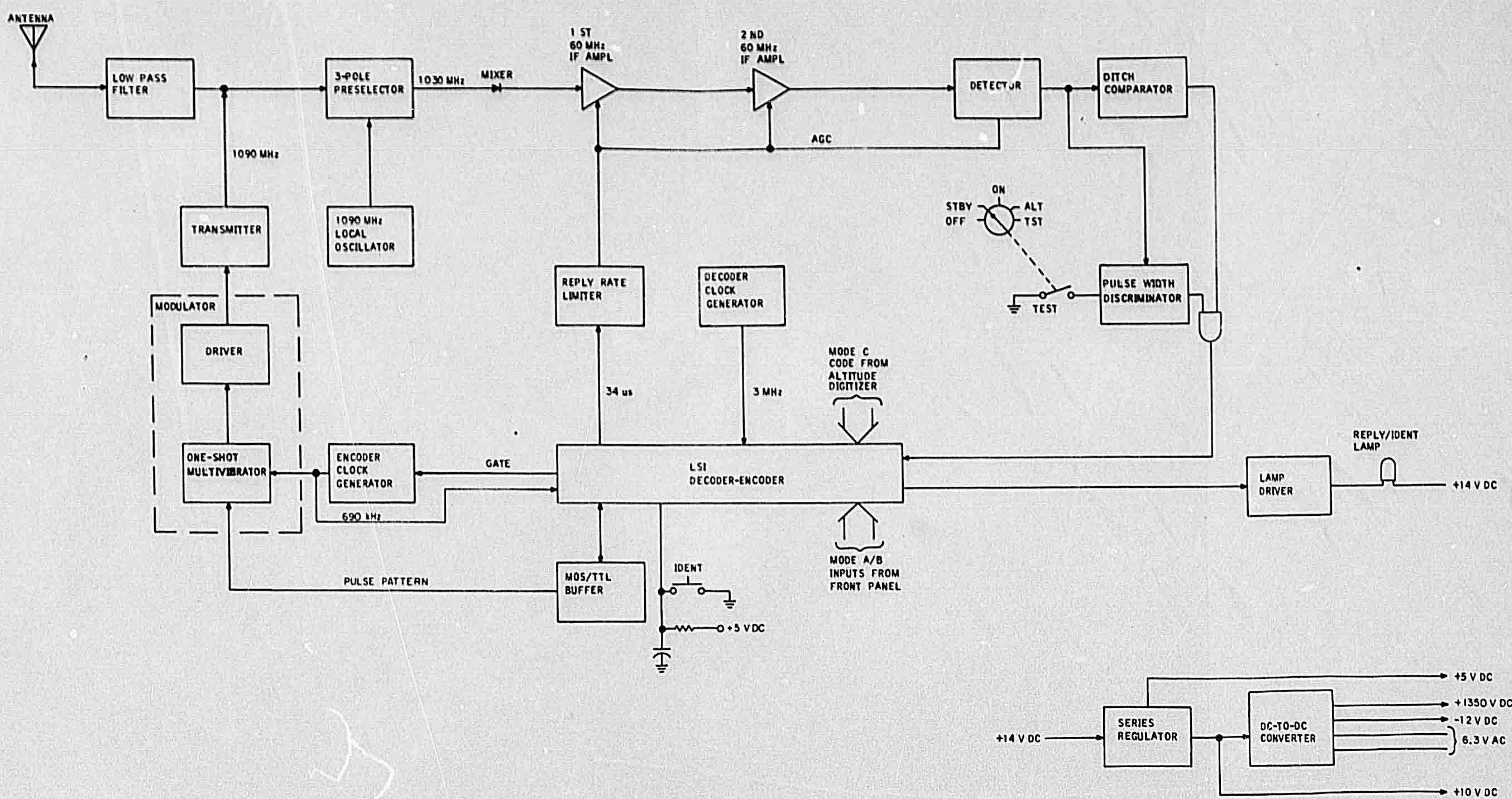
4.3.9 Self-Test

A self-test feature is included in the TDR-950/950L. The self-test process is initiated when the front panel function selector is switched and held in the TST position. The TST switch position is spring loaded to ensure return to a normal operating state when the switch is released.

Selecting the TST position disables the pulse width discriminator circuit, which establishes a clear path for the noise present at the output of the ditch circuit to the LSI circuit. Distributed randomly throughout the noise present at the LSI input are pulses which will be interpreted by the LSI device as valid interrogation pulses. These pulses will be decoded, which in turn causes 34-microsecond reply pulses to be generated. When the transponder is operational, the reply lamp will be steadily illuminated as long as the function selector switch is held in the TST position.

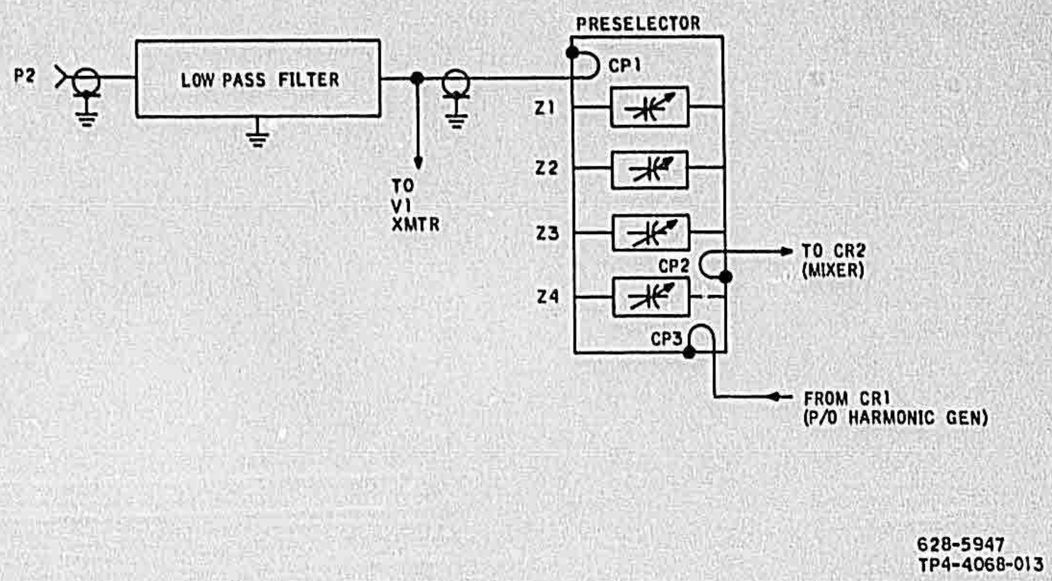
4.3.10 Power Supply

The +14-V dc primary power input is applied to a series regulator that develops +10 V dc. The +5 V dc is zener regulated from the +10-V dc potential. The regulator also supplies the +10 V dc to a dc-to-dc converter that derives the 6.3 V ac for the transmitter tube heater, 1350 V dc for the transmitter anode, and -12 V dc for use throughout the TDR-950/950L.



628-5933
TP4-3628-014

TDR-950/950L Transponder, Functional Block Diagram
Figure 4-5



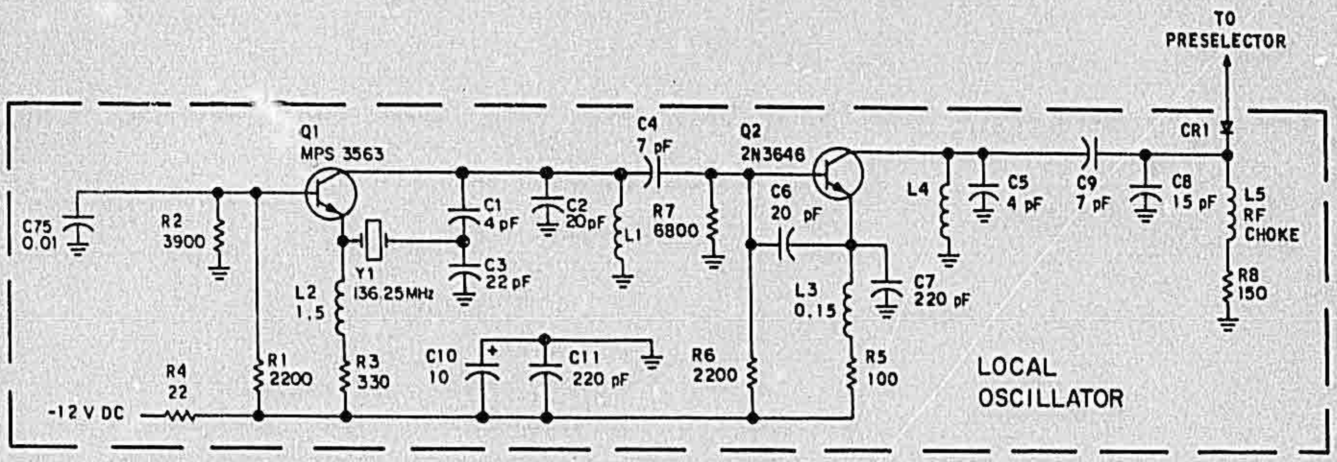
Low-Pass Filter and Preselector
Figure 4-6

4.4 DETAILED THEORY OF OPERATION (Refer to TDR-950/950L unit schematic diagram in section VI.)

4.4.1 Low-Pass Filter and Preselector (Refer to figure 4-6.)

The interrogation signal received at the antenna is fed through the low-pass filter and diplexer to the 3-pole preselector. The low-pass filter is incorporated to attenuate transmitter harmonics. The diplexer section provides two signal paths; the 1090-MHz (transmitter) path provides a high impedance to the received signal (1030 MHz) and a matched impedance to the transmitter signal (1090 MHz), and the 1030-MHz path provides a matched impedance to the received signal and a high impedance to the transmitter signal. This isolates the transmitter from the receiver and provides signal routing. The 1030-MHz output from the diplexer section is applied to the 3-pole preselector.

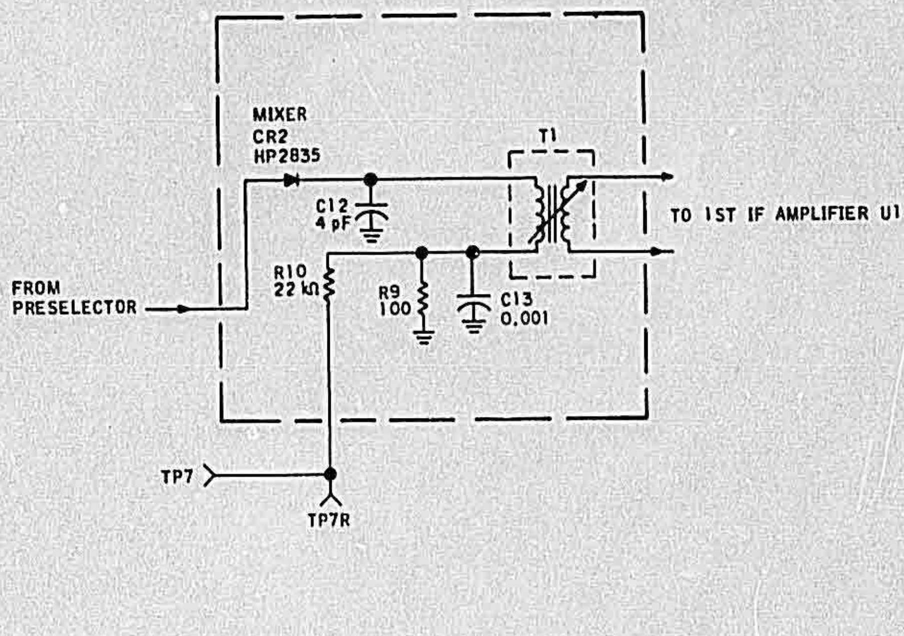
The preselector contains resonators that are tuned to provide a flat response at the bandpass frequency, 1030 MHz, and cause a sharp loss at all other frequencies. The output of the preselector is applied to the mixer.



Local Oscillator
Figure 4-7

4.4.2 Local Oscillator (Refer to figure 4-7.)

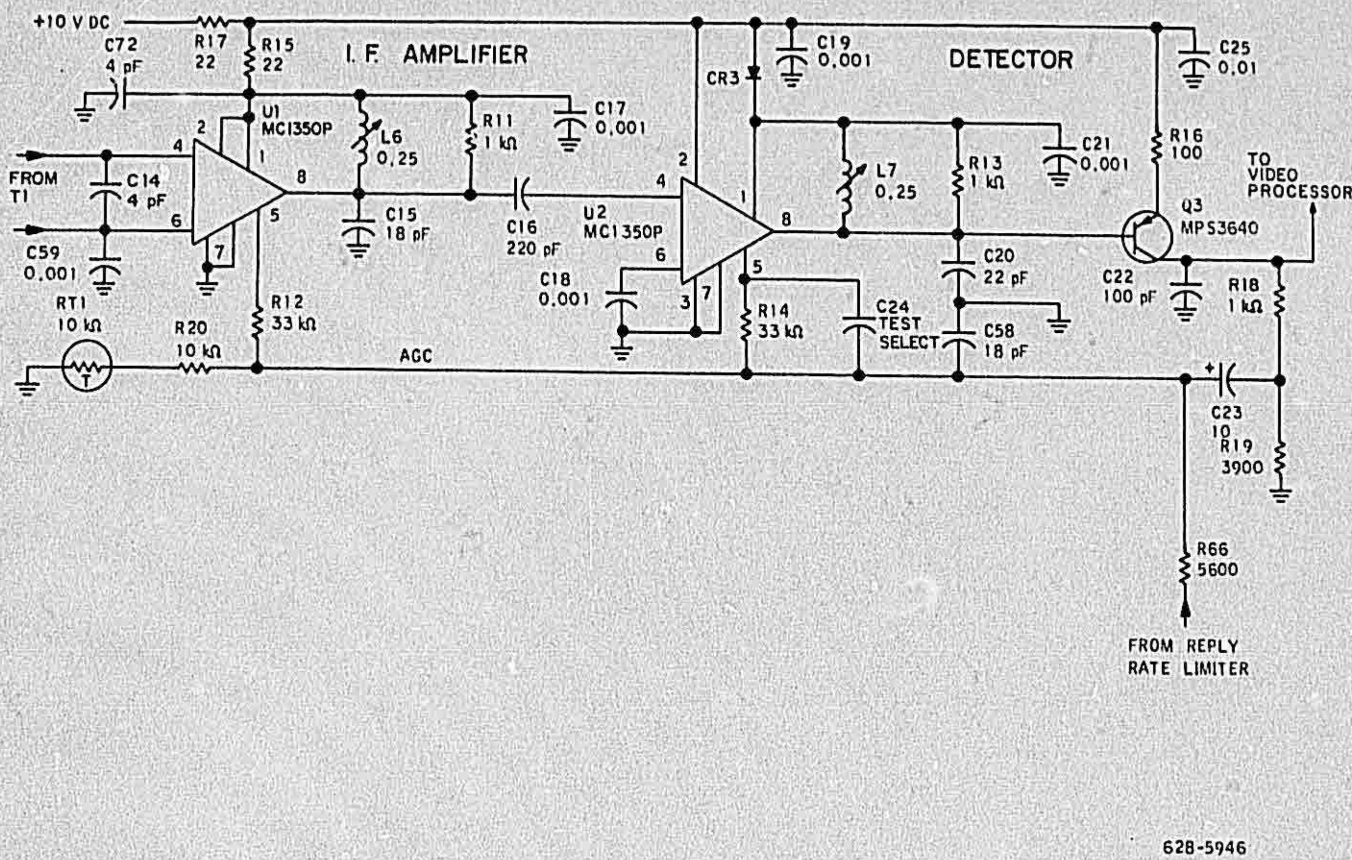
The application of power to the TDR-950/950L forward biases transistor Q1, whose initial conduction excites the oscillator into oscillation. Feedback from the collector to the emitter through C1 and Y1 sustains oscillations; crystal Y1 maintains oscillations at a frequency of 136.25 MHz. The 136.25-MHz signal is filtered by C2 and L1 and capacitively coupled through C4 to frequency doubler transistor Q2. The output of the frequency doubler, 272.50 MHz, is coupled through C9 to harmonic generator CR1. The filter network comprised of C5, C8, C9, and L4 is tuned to 272.50 MHz. Capacitors C8 and C9 match the doubler to the diode multiplier. The output of the local oscillator is filtered by L14 and a resonator contained in the preselector housing, and the 1090-MHz component is applied to the mixer by the preselector output coupling loop.



Mixer
Figure 4-8

4.4.3 Mixer (Refer to figure 4-8.)

The preselector output contains both the injection and received signals that are applied to mixer diode CR2. The 1090-MHz injection is heterodyned with the 1030-MHz received signal in the mixer diode to produce the 60-MHz intermediate frequency. Capacitor C12 shunts the 1090- and 1030-MHz signals to ground and allows the 60-MHz signal to pass. Capacitor C13 bypasses intermediate frequencies to ground. Mixer current is measured by the voltage drop across resistor R9. The mixer output is coupled through matching transformer T1 to the input of the first IF amplifier.



IF Amplifier, Detector, and AGC
Figure 4-9

4.4.4 Intermediate Frequency Amplifier (Refer to figure 4-9.)

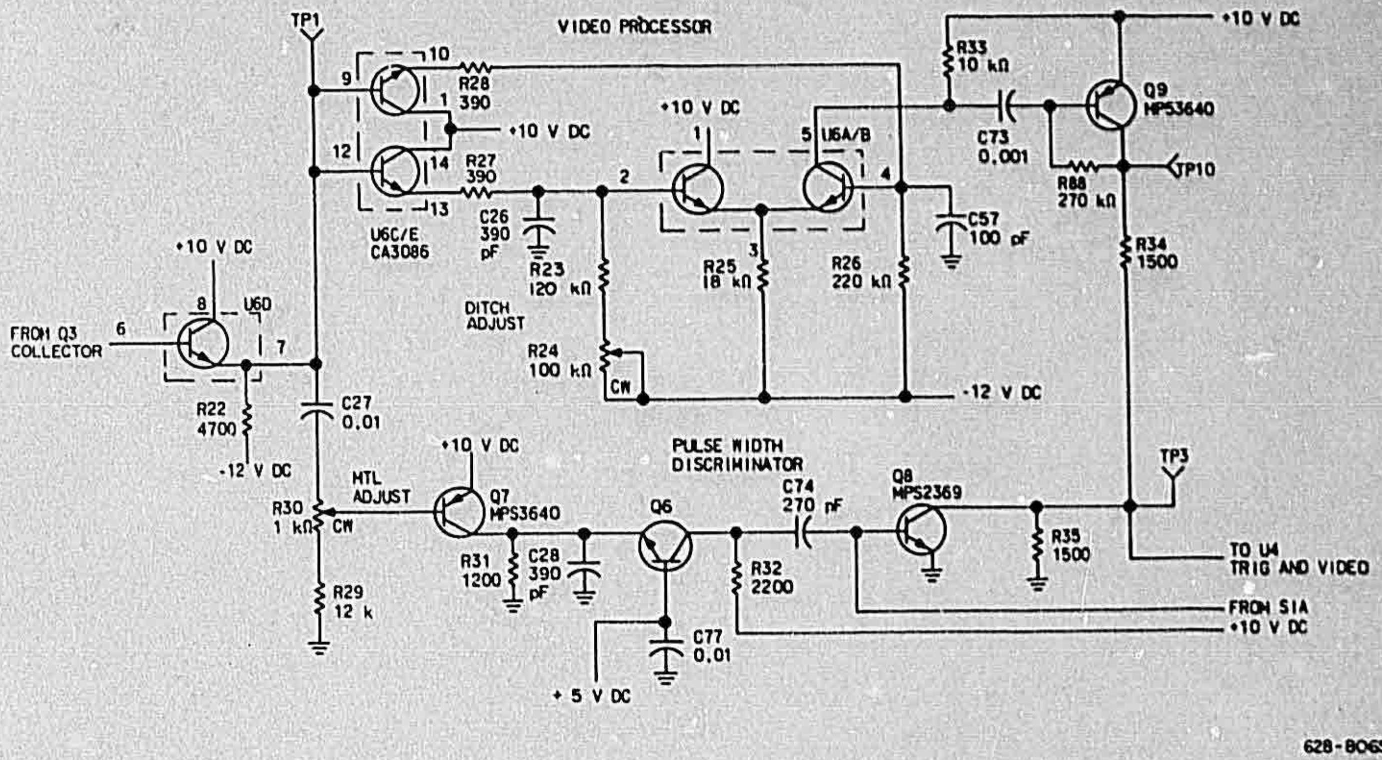
The IF amplifier section consists of two integrated circuit amplifiers and their associated components. The 60-MHz IF signal is coupled through matching transformer T1 to the first IF amplifier U1. The output of amplifier U1 is tuned to 60 MHz by L6 and C15.

Amplifier U2 operates in essentially the same manner as U1. The output of amplifier U2 is tuned by inductor L7 to provide the desired response. Each stage of the IF amplifier section yields approximately 40-dB gain.

4.4.5 Detector and AGC (Refer to figure 4-9.)

The output of the second IF amplifier is applied to the base of detector transistor Q3. The bias network of transistor Q3 provides class B operation. The base bias provided by diode CR3 is slightly larger than the base-emitter turn-on point. This technique provides temperature compensation which ensures that transistor Q3 will provide constant detection over a wide temperature range. Capacitor C22 bypasses the 60-MHz IF signal to ground leaving only the detected video at the collector of Q3.

A voltage divider consisting of resistors R18 and R19 provides the AGC feedback signal from the output of detector Q3 to the IF amplifiers. The AGC dc level produces a small IF gain reduction. An AGC voltage pulse causes further gain reduction in proportion to the pulse amplitude for the duration of the pulse. This type of AGC regulation produces an output which is logarithmic in nature and yields the required dynamic operating range. AGC temperature compensation is provided by thermistor RT1, which controls the positive dc AGC voltage to amplifiers U1 and U2.



Video Processor After REV AA
Figure 4-10

4.4.6 Video Processor (Refer to figures 4-10 and 4-11.)

The video processing circuitry accomplishes the following five tasks: MTL threshold adjustment, narrow-pulse rejection, echo discrimination, side-lobe pulse amplitude sensing, and pulse shaping for the decoder input.

4.4.6.1 MTL Determination and Narrow-Pulse Rejection Before REV AA

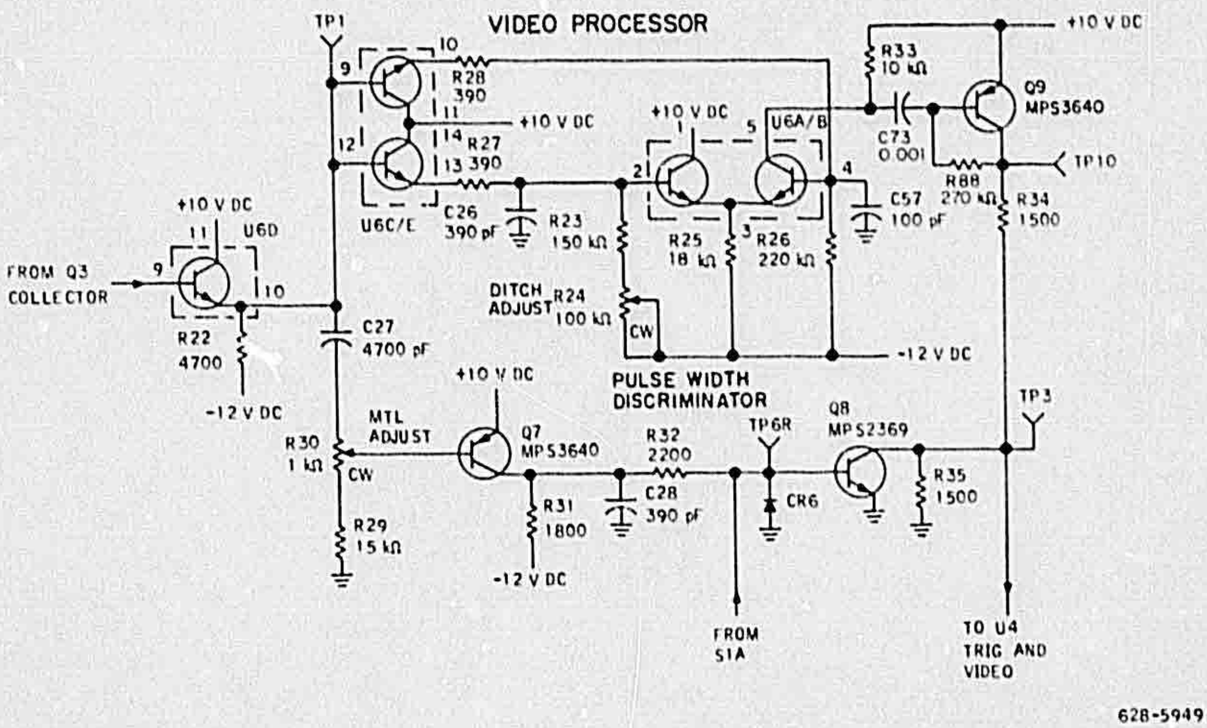
MTL threshold adjustment and narrow-pulse rejection are provided by transistor Q7 and associated components.

The video output of the detector is buffered by U6D, which supplies the detected video to the base of transistor Q7 through C27 and MTL adjust potentiometer R30. The adjustment of R30 determines the pulse voltage necessary to cut off Q7, which establishes the MTL point. In its quiescent state, transistor Q7 will conduct, which saturates transistor Q8 and maintains a positive charge of approximately +10 volts on capacitor C28. Operating in this mode, the output of the comparator circuit, as seen at the collector of Q9, will be channeled to ground through transistor Q8. This action prevents passage of the invalid video processor output to the decoder.

When an interrogation signal of sufficient amplitude is received with a pulse width greater than 0.4 microsecond, transistor Q7 will be cut off, which causes capacitor C28 to charge toward -6 volts from the +10-volt level previously held. When C28 voltage drops below approximately 0.6 volt, Q8 will be cut off, which allows the signal present at the collector of Q9 to pass to the decoder. The RC time constant of R31, R32, and C28 is such that at least a 0.3-microsecond pulse duration is required to turn off Q8. For this reason, if a video pulse is not of sufficient duration to keep Q7 cut off until C28 voltage approaches zero, Q8 will remain saturated, which inhibits the input to the decoder.

4.4.6.2 MTL Determination and Narrow-Pulse Rejection After REV AA

MTL threshold adjustment and narrow-pulse rejection are provided by transistors Q7, Q6, and associated components.



Video Processor Before REV AA
Figure 4-11

The video output of the detector is buffered by U6D, which supplies the detected video to the base of transistor Q7 through C27 and MTL adjustment potentiometer R30. The adjustment of R30 determines the voltage necessary to cut off Q7, which establishes the MTL point. In its quiescent state, transistor Q7 will conduct and supply its positive output to capacitor C28 and transistor Q6. With Q7 conducting, C28 will maintain a positive charge of approximately +10 V dc and C77 will be charged to approximately +5 V dc. Since transistor Q6 is cut off, transistor Q8 will be saturated by the +10-volt supply line and shunt the video processor signal present at Q9 collector to ground. With Q8 conducting, invalid video application to decoder/encoder U4 will be inhibited and no replies will be generated.

When an interrogation signal of sufficient amplitude is received with a pulse width greater than 0.4 microsecond, transistor Q7 will be cut off which causes capacitor C28 to begin discharging. When C28 discharges to below +5 volts, transistor Q6 will conduct and generate a negative-going pulse that cuts off transistor Q8. During the time Q8 is cut off, the detected video output at Q9 collector will be applied to decoder/encoder U4 for processing.

The RC time constant of R31, C28, and R32 is such that at least a 0.3-microsecond pulse duration is required to turn Q8 off. For this reason, if a video pulse is not of sufficient duration or level to keep Q7 off until Q6 is triggered, Q8 will remain saturated and the detector video path to U4 will remain blocked.

4.4.6.3 Amplitude Discriminator (Ditch Circuit)

Amplitude comparison of the P1 and P2 pulses is the primary function of the ditch circuit, although echo suppression is accomplished by the same means.

When the amplitude of P2 is less than P1 by 9 dB or more, the decoding process will be completed and reply pulses will be generated. If the difference is between 0 and 9 dB, generation of the reply pulse is questionable and other factors of the interrogating signal are considered. If the P2 pulse is equal to or greater than P1, no reply will be generated.

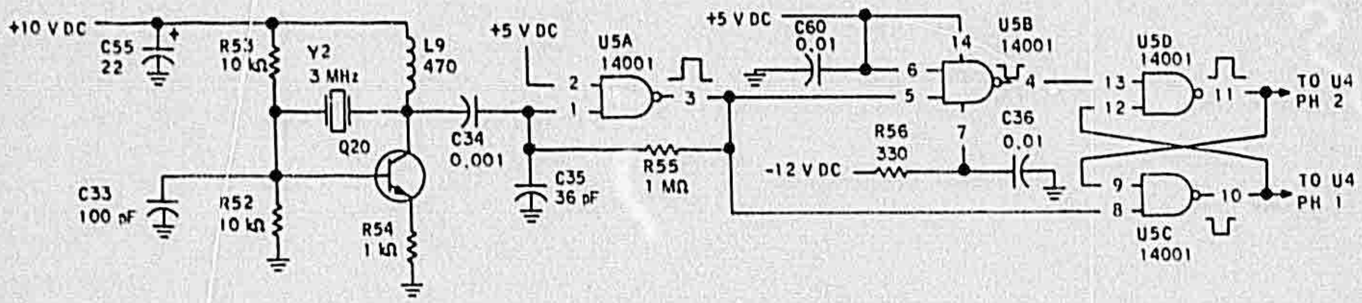
When a video pulse is of sufficient level and duration to cut off transistor Q8, the decoder will receive a pulse if transistor Q9 is conducting. The condition for Q9 conduction occurs when the base voltage of transistor U6A does not exceed the base voltage of U6B.

When a valid P1 pulse is detected, capacitors C26 and C57 will be charged to peak amplitude by the incoming pulse and transistor U6B conducts until the voltage held by capacitor C26, which decays at a much slower rate than that of C57, exceeds that of C57. At this time U6B will be cut off and U6A will begin conducting. Capacitor C57 is used primarily to reduce noise fluctuations at U6B base, while C26 is the storage element in the ditch circuit. With transistor U6B conducting, Q9 will also be triggered momentarily by the incoming P1 pulse. The ditch circuit, consisting of U6E, C26, R23, R24, and R27, generates a dynamic threshold equal to the input pulse peak amplitude which decays at a linear rate after pulse reception. The recovery slope of the ditch voltage is equivalent to approximately 3 dB per microsecond. Shortly after P1 has been detected, approximately 2 microseconds, P2 appears at the detected output. If P2 is equal to or greater than P1, capacitor C57 will be recharged resulting in renewed conduction of U6B and, in turn, Q9. This second pulse from Q9 is recognized by decoder-encoder U4 that inhibits the generation of the reply pulse train. If the P2 pulse is 9 dB less than P1, C57 voltage will not overcome the residual C26 voltage from P1, and U6B will remain cut off as well as transistor Q9. This is recognized as a valid interrogation signal by the decoder (absence of an sls output pulse from Q9) and a reply is generated (provided Q8 is not conducting). Side-lobe pulse amplitude sensing is accomplished in the same manner as is echo suppression. Small echo pulses that closely follow an interrogation pulse and that are less than the ditch voltage will not turn on U6B and Q9; therefore no output will occur.

Pulse shaping is achieved by the video processor due to the switching action of Q8 and Q9. The output amplitude is fixed to 5 volts by Q9 saturation and the leading edge rise time is determined by Q8 turn-off time.

Adjustment of the ditch circuit is accomplished by changing the discharge time constant of capacitor C26. DITCH ADJUST potentiometer R24 is incorporated to provide this adjustment.

DECODER CLOCK GEN



626-5951
TP4-4072-013

Decoder Clock Generator
Figure 4-12

4.4.7 Decoder Clock Generator (Refer to figure 4-12.)

The 3-MHz decoder clock generator is a crystal controlled oscillator operating at the crystal fundamental frequency of 3 MHz. Two 180-degree, out-of-phase clock pulses are provided to pins 32 and 33 of decoder-encoder U4. These clock pulses are used within decoder-encoder U4 to control shift register circuits.

The decoder clock generator consists of a crystal controlled oscillator and a NAND gate network which produces two 3-MHz, 180-degree, out-of-phase clock pulses. When initial power is applied, the crystal oscillator is shocked into oscillation. The oscillator configuration produces good frequency stability by ensuring operation at the series resonant frequency of the crystal. Above or below this frequency, the crystal impedance increases and feedback is reduced. The output of the oscillator is coupled to NAND gate U5A that supplies the 3-MHz pulses to NAND gates U5B and U5C. NAND gate U5B forms an intermediate stage which provides the 180-degree phase reversal present at the output of U5D. The cross-connected combination of gates U5D and U5C ensure generation of the 180-degree phase difference with nonoverlapping, negative-going voltages.

4.4.8 Decoder-Encoder (Refer to figure 4-13.)

4.4.8.1 General

Decoder-encoder U4, referred to as the LSI (large scale integration), is a dual in-line, 40-pin MOS integrated circuit. The primary function of the LSI is decoding the processed interrogation signal and initiating the encoding process. The LSI produces the following four outputs that are used to trigger circuitry external to the LSI: reply pulse train, 690-kHz encoder clock generator enable, a 34-microsecond gate for reply rate limiting, and REPLY lamp triggering.

Reply pulse combinations, determined by the position of the front panel controls or data from an encoding altimeter, are applied directly to the LSI. Internal latch circuits determine the mode of the interrogation and control the encoder output; this is accomplished by monitoring the pulse spacing in the decoder section of the LSI.

4.4.8.2 Decoder

The decoder section of the LSI consists of a shift register and latch circuits that detect the pulse spacing of a mode A, C, or sls pulse pair. Pulses received at the VIDEO input, pin 8, are loaded into the 3-MHz, 62-bit decoder shift register. TRIG pulses from the video processor circuitry are applied to each of the latch circuits where they are compared with their respective inputs from the decoder shift register. Recognition of a properly spaced pulse pair within a latch results in a logic 0 output at the F terminal of that latch. When this transition occurs, NAND gate 3's output goes high and is applied to a buffer, which results in a high output at REPLY pin 4. At the time NAND gate 3 changes state, NAND gate 4 output also has a positive-going transition. The output of NAND gate 4 is also buffered and provides a high output at GATE pin 5. This high output enables the encoder clock generator, and the 690-kHz encoder clock pulses are applied to pin 9 of the encoder section.

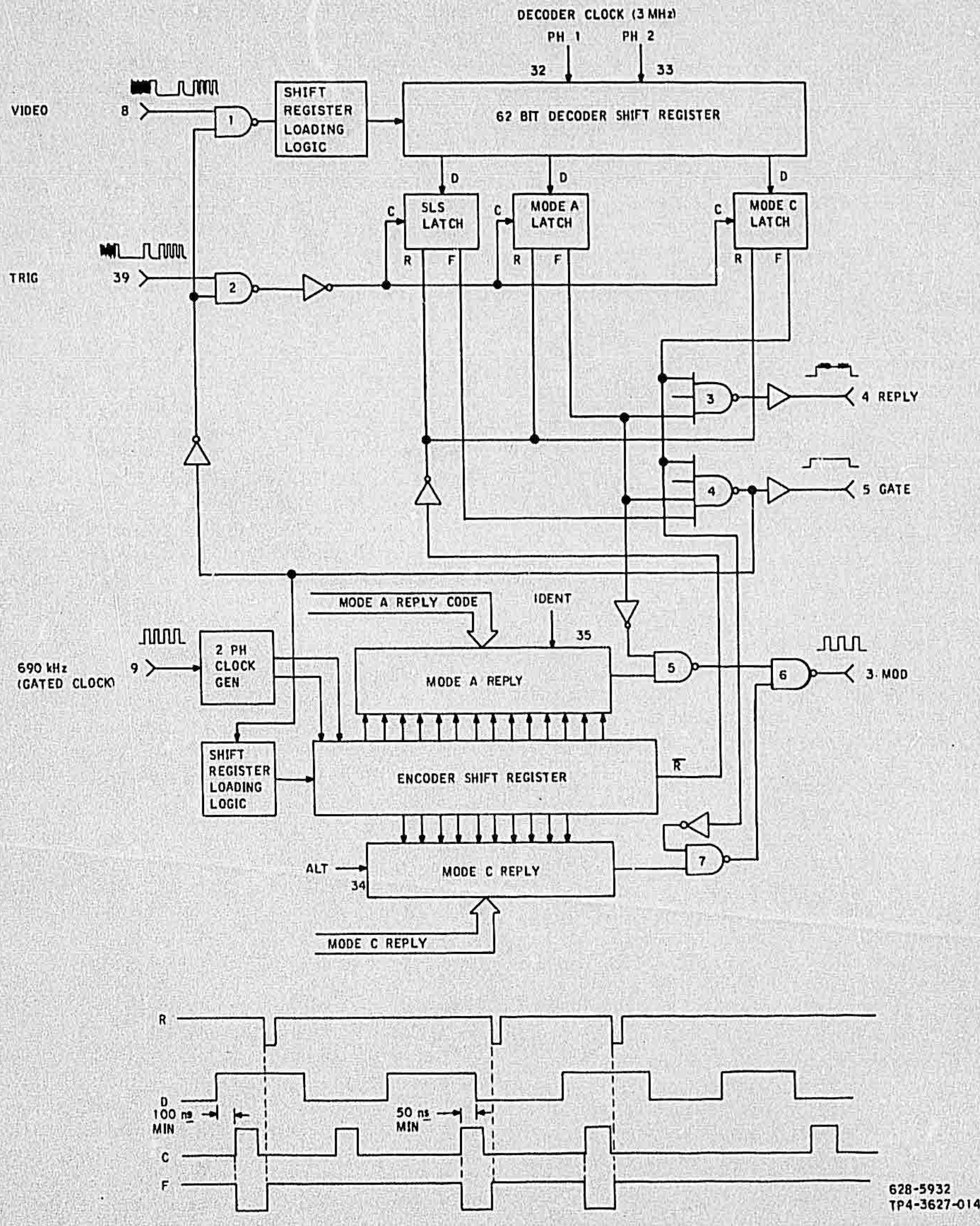
Side-lobe suppression is accomplished by the sls latch. When interrogated by a side lobe, the P1 pulse will be loaded into the decoder shift register. After 2 microseconds, P1 will have been shifted to the sls latch. If the P2 pulse follows the P1 pulse at this 2-microsecond point, the sls latch F output will go low. This initiates a change of state in NAND gate 4, which results in an enable GATE at pin 5. The output of NAND gate 4 is applied to the shift register logic loader and is also inverted and applied to NAND gates 1 and 2. The pulse applied to NAND gates 1 and 2 terminates further decoding by inhibiting the loading of another interrogation into the decoder shift register for a period lasting approximately 34 microseconds. The pulse loaded into the encoder shift register will be shifted down until it emerges at the $\overline{R}$ output of the register, which resets the sls latch and opens the path of processing of another interrogation. Response to an sls interrogation will be suppressed due to the absence of the MOD enabling logic at NAND gates 5 and 7.

4.4.8.3 Encoder

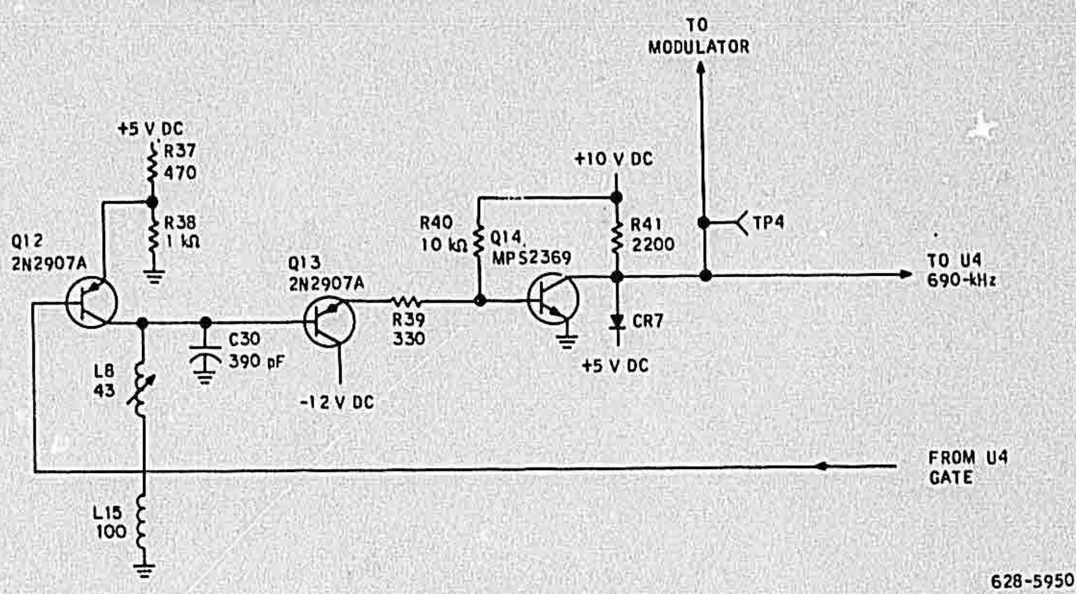
When a mode A interrogation is received and decoded, the F output of the triggered latch will switch to logic 0. This state change is recognized by NAND gate 5, which opens the path for a mode A reply pulse train at MOD pin 3. The reply pulse train will be the code selected on the front panel controls. The encoder shift register is loaded with a single pulse taken from the output of NAND gate 4. As the pulse moves through the encoder shift register, data selected by the mode A reply code will be passed and applied to the MOS TTL buffer Q16 that drives the modulator. The encoder shift register is clocked by the 2-phase encoder clock generator; therefore the mode A output will be dependent upon the 690-kHz clock. Upon completion of a reply pulse train, the $\overline{R}$ output of the encoder shift register momentarily changes state, providing a reset pulse to the latches contained in the decoder section.

Reply to a mode C interrogation produces effects within the LSI that are similar to those of a mode A interrogation.

When a mode C interrogation is received and decoded, the F output of the mode C latch will be logic 0. This causes the output of NAND gate 7 to change state, opening the path for mode C reply pulses. If the mode selector switch on the unit front panel is set to ON, only the F1 and F2 framing pulses will be transmitted. Selection of the ALT position applies mode C altitude data to the mode C reply circuit and the transmission will consist of a complete altitude response, provided an altitude digitizer is used. If an altitude digitizer is not connected and the ALT position is selected, responses to valid interrogations will consist of the framing pulses F1 and F2.



Decoder-Encoder U4, Functional Block Diagram
Figure 4-13

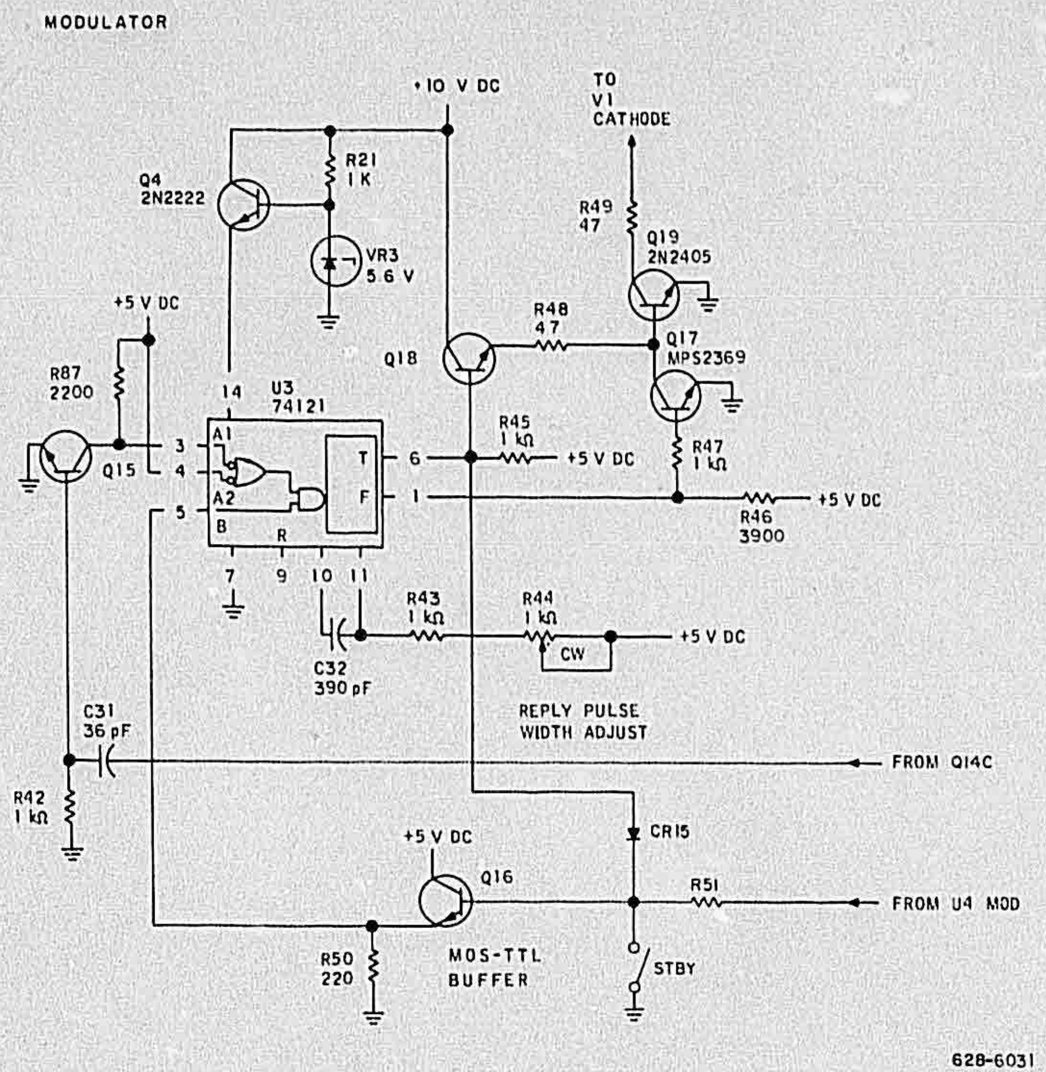


Encoder Clock Generator
Figure 4-14

4.4.9 Encoder Clock Generator (Refer to figure 4-14.)

The encoder clock generator is enabled by decoder-encoder U4 which applies a positive-going gate directly to the base of transistor Q12. The duration of the encoder clock generator operation, 34 microseconds, is controlled by the decoder-encoder. Basically, the encoder clock generator consists of a resonant tank circuit with a frequency adjustable by varying the inductance of L8. When the enable gate is generated, transistor Q12 will be cut off, initiating generation of the 690-kHz clock. The high-impedance input circuit of transistors Q13 and Q14 ensures oscillation with a minimum amount of damping for the full 34-microsecond duration. The output of transistor Q14 is applied to a 2-phase clock generator contained within the LSI and to transistor Q15 in the modulator section.

Inductor L15 (added by Service Bulletin No 5) minimizes unwanted inductance variation in L8 and maintains reply pulse spacing limits well within specification.



Modulator
Figure 4-15

4.4.10 Modulator (Refer to figure 4-15.)

The output of the 690-kHz encoder clock generator is coupled to the base of transistor Q15, which switches the input at pin 3 of the one-shot, 0.45-microsecond, monostable multivibrator U3. The modulating signal, present at pin 3 of U4, is applied to MOS TTL buffer Q16 which supplies the modulating signal to U3 pin 5.

When a modulating pulse is coincident with a 690-kHz pulse, U3 will be triggered and an output will occur. The multivibrator output pulse width is adjusted by potentiometer R44 to obtain the proper reply pulse width duration of 0.45 microsecond. Complementary outputs are provided by multivibrator U3 and are applied to the modulator driver transistors Q17 and Q18. When U3 is triggered, pin 6 will go high and pin 1 low. When this occurs, transistor Q18 turns on and saturates transistor Q19, allowing current to flow from the cathode of the transmitter tube for the 0.45-microsecond pulse duration. At the same time that Q18 and Q19 begin conducting, transistor Q17 will be cut off by the low output present at U3 pin 1. Prior to U3 triggering, Q17 will be conducting. At the end of the modulation pulse, Q17 saturates, turning off Q19. In standby Q16 base is grounded, which inhibits the modulator.

Transistor Q4 and diode CR15 are incorporated to prevent oscillation from occurring in 28-volt installations when power is momentarily removed and quickly reapplied, and to ensure a stable V_{cc} supply is present at U3 at all times.

Diode CR15 grounds the output of U3 whenever the function selector is in the STBY position. When switching from on to off and quickly back to on again, the momentary ground supplied by CR15 shunts positive-going pulses to ground while the transmitter is still hot, and allows sufficient time for the power supply to build to normal operating potential.

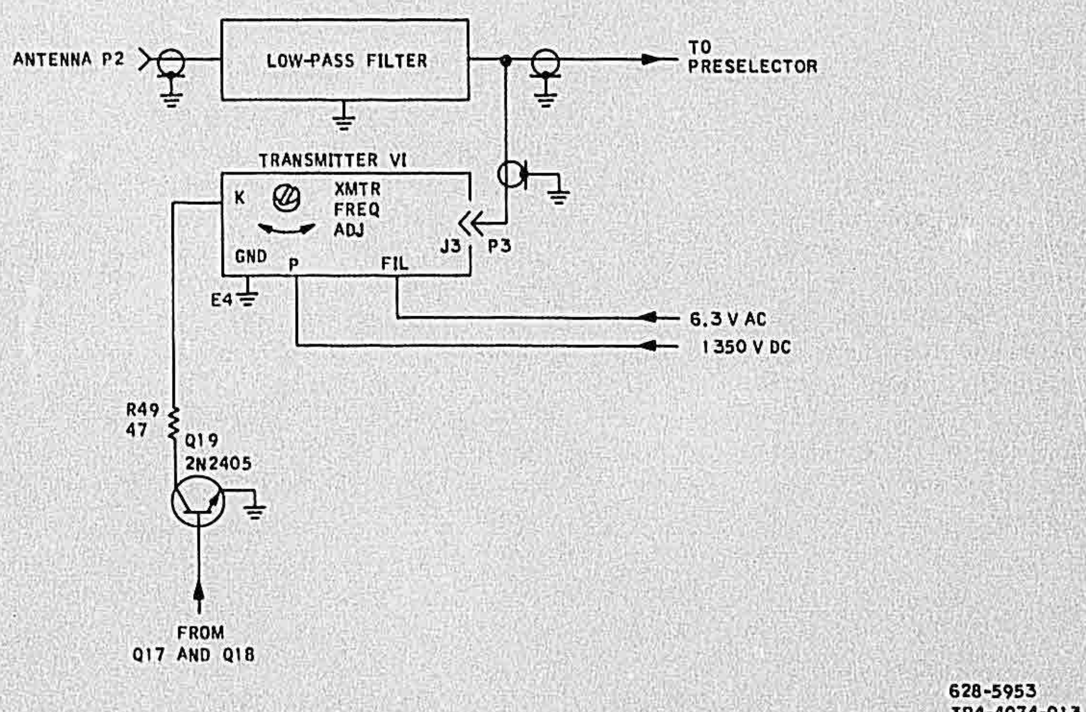
Transistor Q4 and zener VR3 provide a stable +5 V dc, V_{cc} source voltage for U3 and ensures a pulse-width output that is free of jitter at all times. This circuit ensures that a stable V_{cc} is present at U3 regardless of slight variations in the +10-V dc supply.

Diode CR15 was added by Service Bulletin No 7, and the V_{cc} regulator circuit was added by assembly revision letter AB.

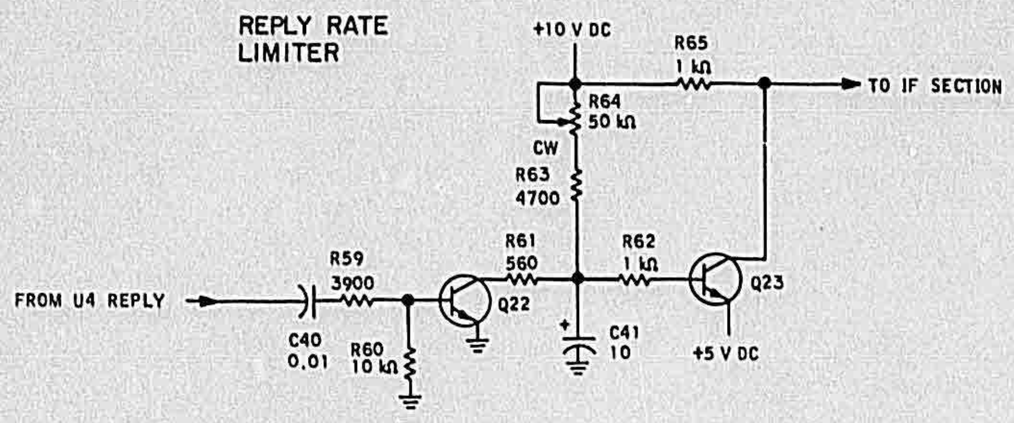
4.4.11 Transmitter (Refer to figure 4-16.)

Transmitter V1 is a triode vacuum tube cavity oscillator that generates the required rf power. This tube delivers a minimum of 250 watts (TDR-950); 140 watts (TDR-950L) peak power output at 1090 MHz. The rf frequency is tuned by adjusting a single screw located on the tube case, which varies a capacitive probe inside the plate cavity. The transmitter output is applied to the diplexer, where it is directed to the low-pass filter. The low-pass filter attenuates harmonics generated by the transmitter cavity. This ensures that only the 1090-MHz pulse-modulated signal is applied to the antenna. The transponder antenna will radiate a pattern essentially that of a one-quarter wavelength monopole mounted vertically on a ground plane.

The transmitter is a nonrepairable item. If a faulty tube is detected, the entire assembly must be replaced.



Transmitter
Figure 4-16



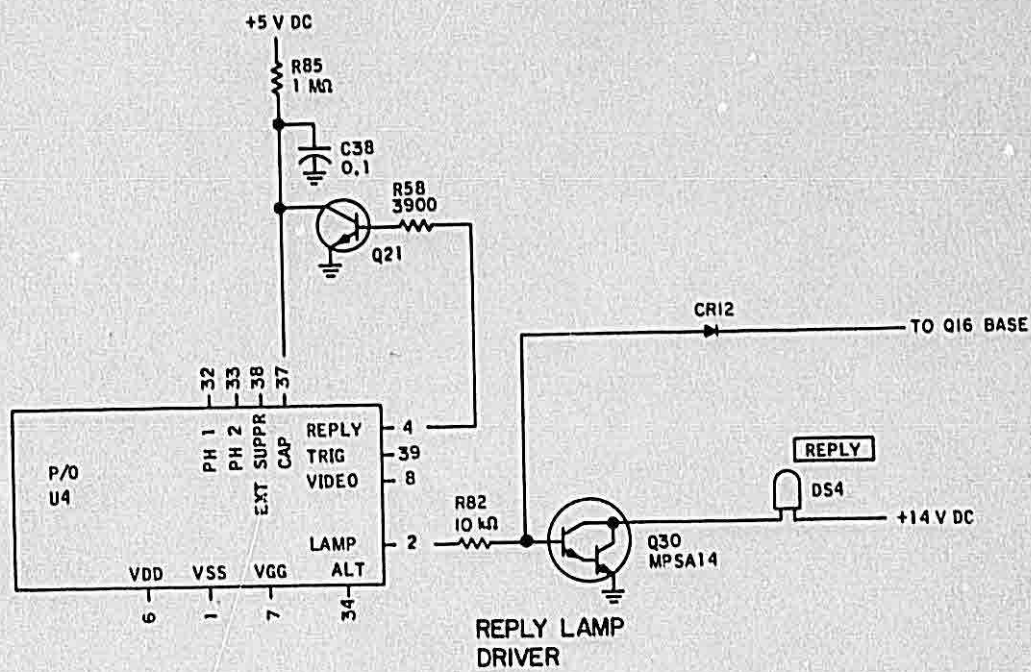
628-5952
TP4-4073-013

Reply Rate Limiter
Figure 4-17

4.4.12 Reply Rate Limiter (Refer to figure 4-17.)

The reply rate limiting circuitry monitors the REPLY output of decoder-encoder U4. Reply rate limiting is necessary to prevent exceeding the 1200-replies-per-second limit when being interrogated by many ground stations at the same time. When the reply rate limit is approached, the reply rate limiter circuit will automatically reduce the gain of the IF amplifier. This reduces sensitivity to interrogations, thereby eliminating replies to weaker (more distant) stations while continuing service to stronger (close) stations.

As the number of replies begins to increase above the set limit, the frequency of the 34-microsecond pulses will increase, which causes transistor Q22 to discharge C41. When C41 discharges to 5 volts, Q23 turns off, which raises the positive level at the collector. As this level increases, the AGC voltage also increases, decreasing the gain of the IF stages. Operating at reduced gain, the sensitivity of the IF stages will be decreased; therefore only stronger interrogations will be processed. When no replies are being generated, reply rate limiting circuitry will be disabled and IF amplification circuitry will operate at full gain.



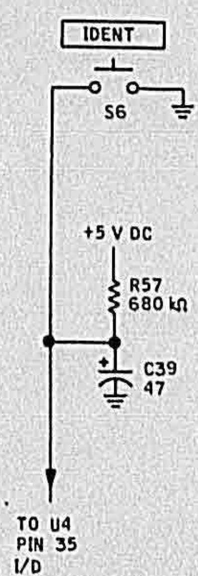
REPLY Lamp Circuitry
Figure 4-18

4.4.13 REPLY Lamp (Refer to figure 4-18.)

The REPLY lamp is used to indicate that replies are being generated in response to a valid interrogation. The 34-microsecond output is provided by decoder-encoder U4 to drive the REPLY lamp circuit as well as the reply rate limiter.

The 34-microsecond REPLY pulse present at U4 pin 4 when responses are made to valid interrogations is applied to the base of pulse stretcher transistor Q21. The high output applied to Q21 saturates the transistor, discharging capacitor C38. When this occurs, CAP pin 37 will be low (logic 0) for the 34-microsecond pulse duration plus the time required to recharge capacitor C38, a total of approximately 50 milliseconds. The logic 0 at U4 pin 37 initiates switching within the decoder-encoder, which causes LAMP pin 2 to go high (logic 1) for the stretched 50-millisecond pulse duration. The output of LAMP pin 2 is applied to the lamp driver Darlington transistor Q30 that saturates both elements. This provides the ground necessary to illuminate REPLY lamp DS4.

In the absence of the 34-microsecond pulse transistor, Q21 will be cut off, capacitor C38 will remain fully charged, and a logic 1 will be present at U4 CAP pin 37. Decoder-encoder U4 will provide a logic 0 at LAMP pin 2 that disables lamp driver Q30. In SBY, Q30 base drive is shunted through CR12 to ground, thereby disabling the REPLY lamp.

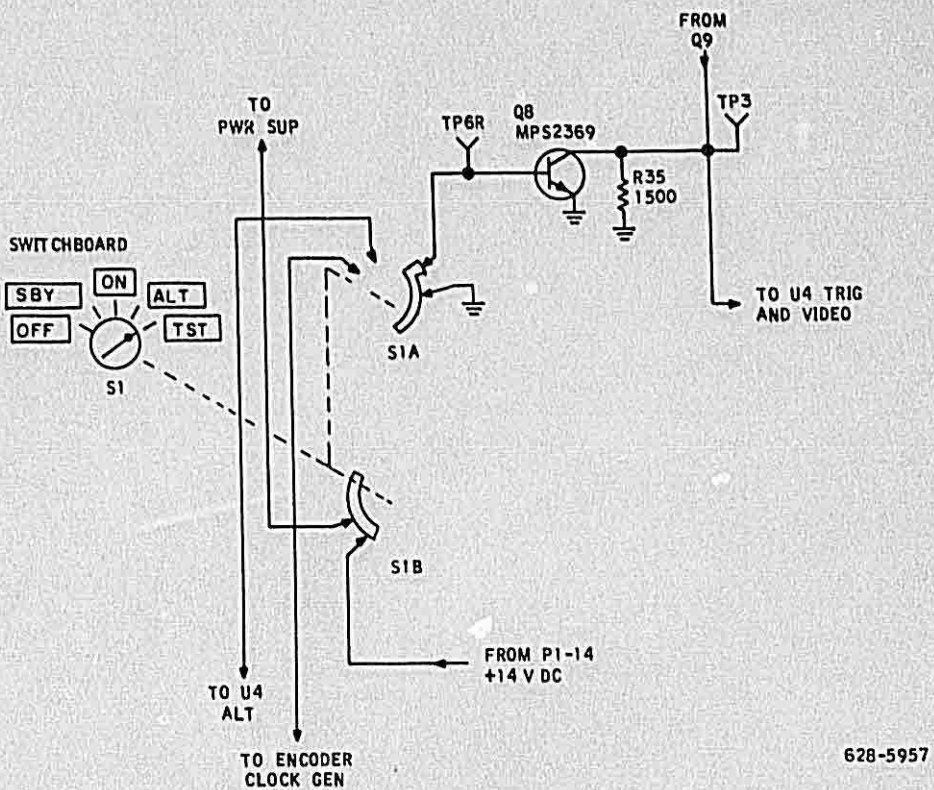


IDENT Button Switching
Figure 4-19

4.4.14 Special Position Identification Pulse (Refer to figure 4-19.)

Upon request of the air traffic controller to squawk ident, IDENT button S6 is momentarily depressed to initiate the ident function. Depressing the IDENT button adds an additional pulse (referred to as a special position identification pulse) at the end of the reply format for a period of 22 seconds. This SPIP generates a unique display on the air traffic controller's radarscope that is used to positively identify the aircraft.

Depressing the IDENT button places a ground at decoder-encoder U4 I/D pin 35 and discharges capacitor C39. Discharging capacitor C39 results in a logic 0 at I/D pin 35 for a period lasting approximately 22 seconds (RC time constant of C39 and R57). During this time the SPIP will be generated by the encoder and applied to the reply pulse format. As an indicator of SPIP transmission, the REPLY lamp will remain on for the 22-second duration as opposed to flashing during transmission of a normal reply period. To summarize, decoder-encoder U4 is virtually independent of any external circuitry as it synthesizes and processes the SPIP.

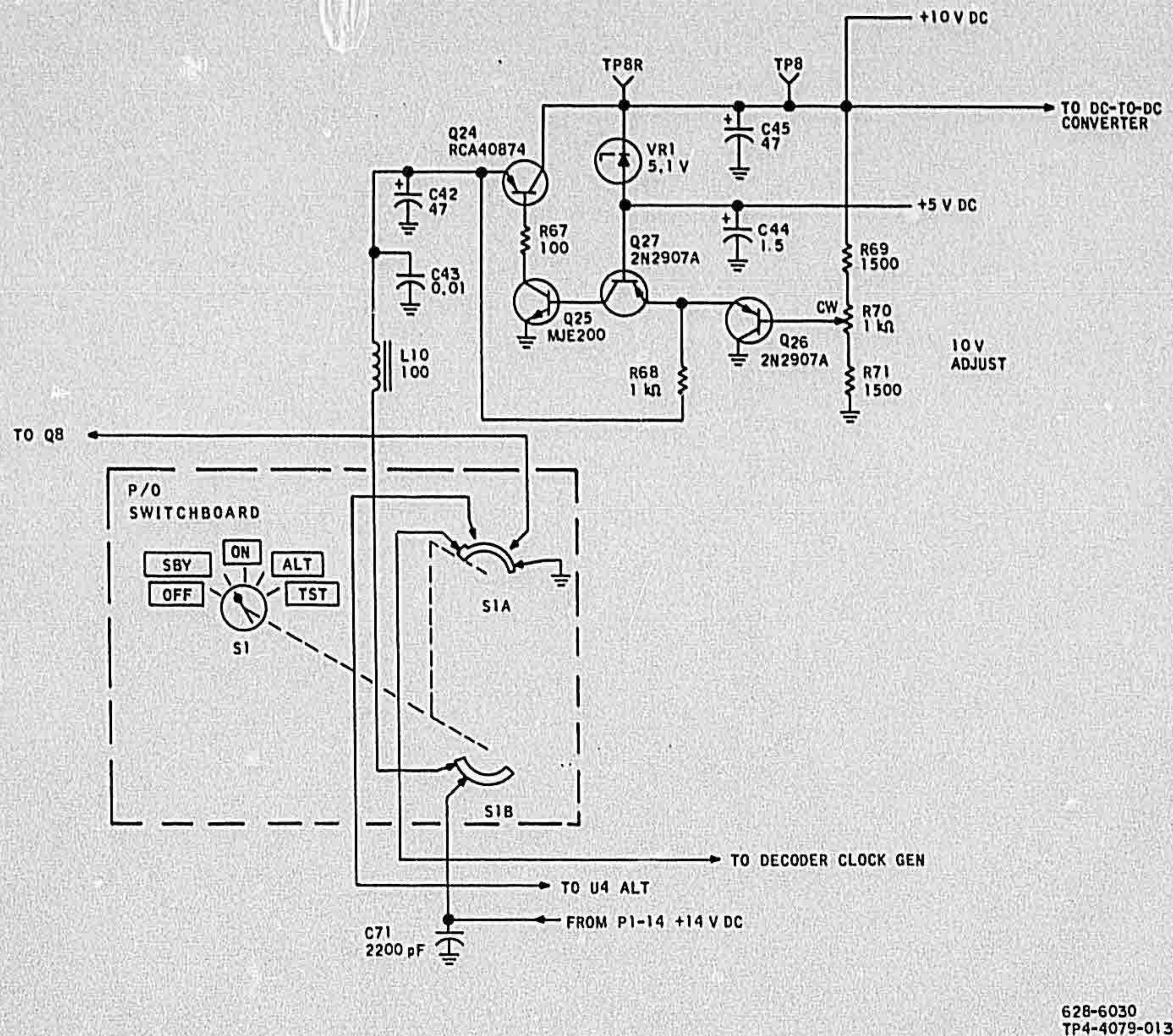


Self-Test
Figure 4-20

4.4.15 Self-Test (Refer to figure 4-20.)

The self-test provision checks the ability of the transponder to receive an interrogation, amplify and detect the signal, and decode the interrogation. If all circuits are functioning normally, the REPLY lamp will light and remain on as long as the TST position is maintained. The self-test function is initiated by selecting and holding function selector switch S1 in the TST position. This position is spring loaded, which ensures that upon release the transponder will return to a normal operating mode.

Selecting the TST position places a ground on the base of transistor Q8. As long as the function selector switch is held in the TST position, Q8 will remain cut off, which allows the noise present at the collector of transistor Q9 to be passed to decoder-encoder U4. Randomly distributed throughout the noise are pulses which will be interpreted by the decoder-encoder as valid interrogation signals. These signals start the decoding and encoding processes. If all circuits are operational, the 34-microsecond pulse will be generated and the REPLY lamp will remain illuminated.



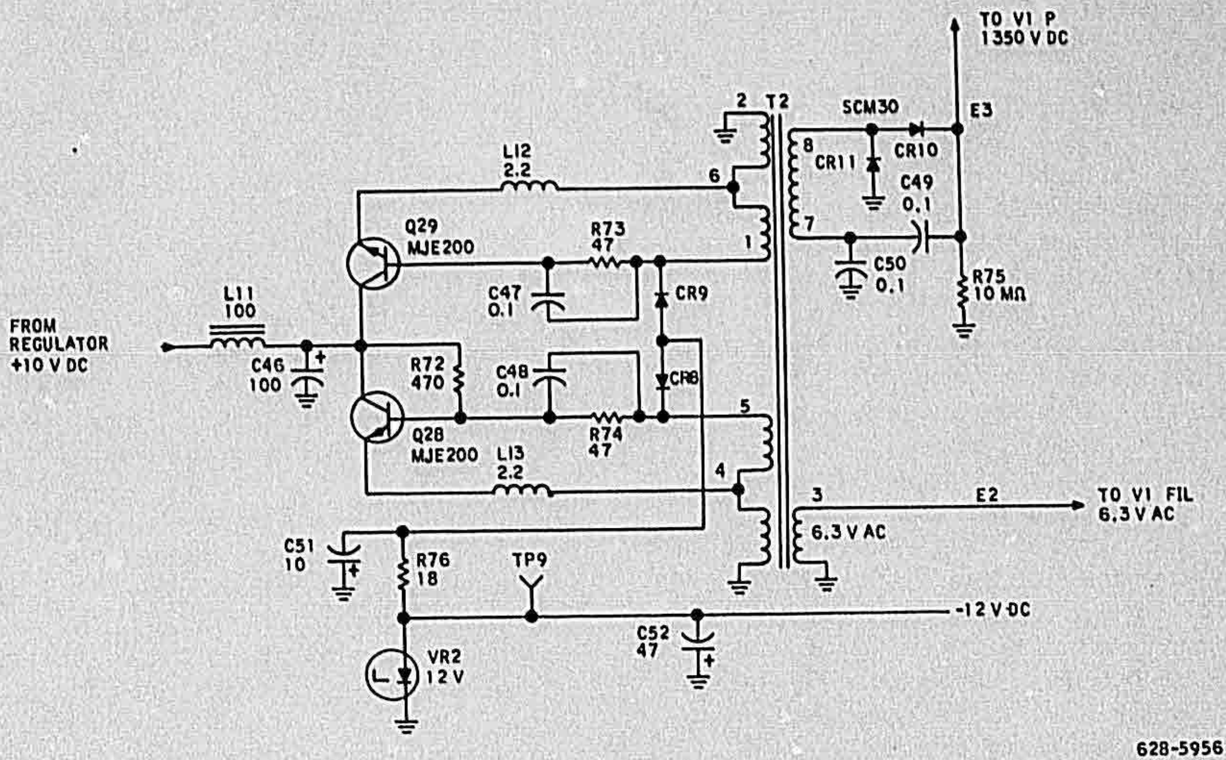
Series Regulator
Figure 4-21

4.4.16 Power Supplies

4.4.16.1 Series Regulator (Refer to figure 4-21.)

The primary +14-V dc aircraft power is applied to rear connector P1 pin 14 and routed to switch S1B. When power is applied to the unit by S1B, the +14 V dc is applied to a filter consisting of L10, C42, and C43 that removes line transients present on the primary power input line. The filtered input power is applied to regulating transistor Q24. The regulated output of Q24 is sampled by the control elements of the regulator consisting of transistors Q25, Q26, and Q27 via the voltage divider network of resistors R69, R70, and R71. The sampled voltage will become the error or correction voltage if the regulated output deviates from the +10-V dc level. The +10-V dc output is adjusted by potentiometer R70 that sets the bias applied to the base of transistor Q26. Should the regulated output voltage increase, transistor Q26 will conduct more heavily, transistor Q27 will conduct less, and the base current of transistor Q25 will be reduced. Transistor Q25 regulates the base current of Q24 and, under these conditions, reduces its collector current that changes the regulated voltage back toward +10 volts. If the regulated voltage drops below the +10-V dc level, the regulating process reverses.

The output of the +10-V dc regulator is applied to the dc-to-dc converter.



DC-to-DC Converter
Figure 4-22

4.4.16.2 DC-to-DC Converter (Refer to figure 4-22.)

The dc-to-dc converter shown in figure 4-22 is actually a free-running oscillator that produces an unregulated square-wave output from the +10-V dc input. The dc input is effectively chopped into complementary square waves by Q28 and Q29, passed through transformer T2, and finally rectified, doubled, and filtered.

The regulated +10-V dc input is applied to transistors Q28, Q29, and Resistor R72. The primaries (6-2 and 4-2) and control windings (1-6 and 4-5) of transformer T2 are part of the free running oscillator mentioned earlier. During each duty cycle, transistors Q28 and Q29 are driven between cutoff and saturation through the primary positive-feedback windings of transformer T2. For the first half cycle, the voltage across the transformer primary stays constant as the flux steadily increases. When the core finally saturates, magnetizing current suddenly rises to its peak value, the rate of magnetizing flux rise decays to zero, and the voltage across the primary winding collapses. When the collapse occurs, the base drive to the saturated transistor is removed, thereby turning it off. The 675-volt secondary voltage at terminals 7 and 8 is applied to a full-wave voltage doubler to produce the +1350-V dc anode voltage for transmitter tube V1. Capacitors C49 and C50 provide filtering of the rectified output. Bleeder resistor R75 is incorporated to discharge C49 and C50 after unit power has been removed.

A -12-V dc potential is obtained by zener regulation of the voltage present at the common anodes of diodes CR8 and CR9. The -12 V dc is used in various portions of the TDR-950/950L.

The 6.3-V ac filament voltage for transmitter tube V1 is derived from another secondary winding of transformer T2.

4.4.17 Panel Illumination

The TDR-950/950L front panel is illuminated by lamps DS1, DS2, and DS3. Operating voltage for these lamps is provided by the aircraft panel lighting dimmer control. Connection is made at rear connector P1 pin 13.

4.4.18 Suppression Circuits

4.4.18.1 TDR-950/950L with Service Bulletin 1

Units with Service Bulletin 1 have both incoming and outgoing suppression. In some aircraft transponder installations noticeable interference may exist between the transponder and DME equipment.

Outgoing suppression is generated when a pulse is received at the base of transistor Q11. A 36-microsecond duration suppression pulse is generated and made available at P1-2 for application to other L-band equipment contained in the aircraft. This suppression pulse effectively disables external L-band transmissions until the TDR-950/950L has completed its transmission. If another L-band transmitter in the aircraft transmits, it sends a blanking pulse to the incoming suppression circuit consisting of Q10 and associated components. The incoming suppression circuit will disable the encoding process of decoder-encoder U4 for the duration of the blanking pulse thus allowing the external L-band transmitter time to complete its transmission without interference from the TDR-950/950L.

4.4.18.2 TDR-950/950L with Service Bulletin 9

Units with Service Bulletin 9 have incoming suppression only.

In some installations, noticeable interference may exist between the transponder and DME equipment. The incoming suppression circuit disables the transponder while conflicting on-board pulse equipment is transmitting and thereby eliminates the possibility of interference between the two.

Operation of the incoming suppression circuit starts when any positive voltage ranging from 5 to 50 V dc is applied to P1-2 causing transistor Q10 to conduct. When Q10 is turned on, the encoding process of U4 is disabled and no replies are generated. The transponder will be suppressed only as long as the positive voltage is maintained at P1-2. Once the positive voltage is removed, the transponder resumes normal operation and reply to valid interrogations.

Collins TDR-950/950L Transponder

Rockwell International

maintenance

Collins General Aviation Division

Printed in USA

523-0766469-006118
6th Edition, 1 August 1984

table of contents

NOTICE: This section replaces fifth edition dated 15 May 1980.

Collins TDR-950/950L Transponder

Rockwell International

maintenance

Collins General Aviation Division

Printed in USA

523-0766469-006118
6th Edition, 1 August 1984

table of contents

2

NOTICE: This section replaces fifth edition dated 15 May 1980.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	1 Sep 75		None	6th Ed	1 Aug 84	S. L. 12/21/84	Those above plus SB 10R1, SIL 2-82
2nd Ed	1 Apr 76		SB 1, 2; SIL 1-75 thru 4-75, 1-76				
1	1 Aug 76		Those above plus SB 3; SIL 2-76, 3-76				
3rd Ed	1 Oct 76		Those above plus SB 4, SIL 4-76				
1	15 May 77		Those above plus SIL 5-76, SB 5, SB 6, SIL 1-77 thru 3-77				
4th Ed	2 Oct 78		Those above plus SB 7, 8; SIL 1-78, 2-78				
5th Ed	15 May 80		Those above plus SB 9; SIL 1-79				

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID
ERRATA 1	Maintenance 5-10	11-8-85	1-16-85	ATP/AC		1H23

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

5.1 GENERAL

This section contains information necessary to maintain, repair, test, and align the TDR-950/950L Transponder. Table 5-1 is a listing of the terms and abbreviations used in this section.

5.2 REPAIR PROCEDURES

5.2.1 Troubleshooting and Replacement of MOS/CMOS Devices

All MOS devices are subject to damage by electrostatic charges. The very high resistance of the oxide insulation used within the MOS imposes a negligible load on electrostatic potentials and therefore does not provide an effective discharge path for sources of static electricity. Although some MOS devices do contain integral gate-protection systems, good practice dictates careful handling of all MOS packages. The following precautions should be observed when handling MOS devices and are applicable to both in-circuit and out-of-circuit environments.

Caution

Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors, PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of these components contain internal gate protection circuits that are partially effective, but good practice dictates careful handling of all electrostatic sensitive components.

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

a. Deenergize or disconnect all power and signal sources and loads used with the unit.
b. Place the unit on grounded conductive work surfaces.
c. Ground the repair operator through a conductive wrist strap or other device using a 1-MΩ series resistor to protect the operator.
d. Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.
e. All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.
f. When these devices and assemblies are removed from the unit, they should be placed on the conductive work surface or in conductive containers.

Table 5-1. Description and Specification of Terms.

TERM	DESCRIPTION
CW level between pulses	At least 60 dB below peak pulse level
Desensitization pulse	A single pulse 0.8 microsecond wide, as measured at the raw video point, used for the purpose of measuring echo suppression characteristics.
Echo	An invalid interrogation received in conjunction with, and usually of a lesser amplitude than, a valid interrogation.
Fall time	Time measured from the 90-percent to the 10-percent amplitude on the trailing edge of a pulse.

Table 5-1. Description and Specification of Terms (Cont).

TERM	DEFINITION
Interrogation rate	The number of interrogations per second generated by the interrogator.
Interrogation signal level	The signal generator attenuator reading expressed in dB above MTL, taking into account cable losses.
Minimum trigger level (MTL)	The lowest signal level of a standard main lobe interrogation measured at the transponder antenna connector, required to maintain 90-percent reply efficiency. MTL is determined by subtracting the cable loss between the isolation monitor and the transponder from the signal generator attenuator reading.
Pulse spacing	Time measured between the 50-percent amplitude points on the leading edges of two designated pulses (unless otherwise specified).
Pulse width	Time measured between the 50-percent amplitude points on the leading and trailing edges of a single pulse.
Receiver signal	1030 ±0.2 MHz
Reply efficiency	The reply rate divided by the interrogation rate, expressed as a percentage.
Reply rate	The number of reply pulses per second; measured at U4 pin 4.
Rise time	Time measured from 10-percent to the 90-percent amplitude on the leading edge of a pulse.
Side-lobe interrogation	Pulse spacing: Pulse designated P2, spaced 2.0 ±1 μs following P1. Signal level: 0 to 50 dB above MTL, with P1 = P3 ±1 dB, P2 variable from -10 to +2 dB with respect to P1 and P3.
Signal level	0 to 50 dB above MTL, with P1 = P3 ±1 dB.
Special position identification pulse (SPIP)	Serves to identify the aircraft at the request of the ATC. The SPIP appears 24.65 μs after the first framing pulse, F1.
Standard interrogation signal	Rise time: Between 0.05 and 0.1 μs. Fall time: 0.8 ±1 μs. Main lobe spacing (between two pulses designated P1 and P3) Mode A: 8.0 ±0.1 μs. Mode C: 21.0 ±0.1 μs.

Table 5-2. Tools Required.

DESCRIPTION	CHARACTERISTIC	FUNCTION
20-watt soldering iron	Any	General soldering functions.
Solder sucker	Any	Remove solder.
Cleaning solvent	Turcosol or Stoddard solution	Remove excess rosin flux; general cleaning applications.
Cutting tools	Various, small diagonal cutter, end nippers, etc (sharp tools that will not leave burrs)	Cut component leads, wire, etc.
Tweezers (metal) or small curved needle-nose pliers	Any having a maximum jaw width of 0.030 inch	Hold and maneuver component leads or wires; provide heat sink for soldering operations.

g. When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.
h. Do not handle these devices unnecessarily or remove from their packages until actually used or tested.

Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

5.2.2 Replacement of Integrated Circuits

Integrated circuits (IC's) are delicate items and should not be replaced until all other defects are eliminated and it is determined the IC is definitely defective.

Note the orientation of the IC on the board before removal to assure correct placement of the new part. Remove the old IC by clipping each lead on the IC using a small diagonal cutter. Heat the leads with a soldering iron and pull them from the board with needle-nose pliers. Clear excess solder from the holes with a solder sucker. This procedure avoids overheating the circuit board and damaging other components or the board itself.

When soldering the new IC into place, avoid excessive heating. An excessive amount of heat may cause internal damage to the IC, making it inoperable. After soldering, use a toothpick to remove any heavy rosin deposits. Solder joints should be smooth, bright, and clean.

5.2.3 Component Repair

Refer to table 5-2 for tools and supplies needed to perform repair work. Equivalent materials may be substituted.

Prior to removing components or disconnecting wires, note polarity, color coding, position, insulation characteristics, and any other distinguishing features important in component replacement. Restore all wiring and cables to proper dress before reassembling unit.

Note

Special care must be taken when replacing or repairing coax connected to the low-pass filter assembly. Coax length is critical and must be maintained to ensure the correct impedance matching. Figure 5-1 shows the TDR-950/950L chassis assembly and critical wire lengths.

Check repairs by performing continuity checks on all repaired circuits. Perform the minimum performance test procedures after repair to ensure proper operation and performance.

Caution

When soldering, take care to prevent thermal damage to adjacent wiring or parts. Remove all excess solder to prevent shorts.

5.3 DISASSEMBLY/ASSEMBLY

The TDR-950/950L Transponder is a panel-mounted unit contained in a 41.3 mm (1.6 in) by 159 mm (6.25 in) by 207 mm (8.15 in) case. Electrical connections are made through one 15-pin connector and an antenna connector located on the rear of the chassis. The TDR-950/950L has been designed to provide direct access to all components with minimum effort. Removal of the unit top and bottom covers completely exposes both sides of the circuit board which allows component replacement without removal of the board.

The mechanical simplicity of the TDR-950/950L eliminates the need for detailed disassembly/assembly procedures. However, the exploded view shown in figure 5-2 should be carefully examined before attempting disassembly.

5.4 TEST EQUIPMENT

Table 5-3 lists equipment required for testing and aligning the TDR-950/950L. Specifications of the listed test equipment must be met or exceeded to ensure proper results.

5.5 TESTING AND ALIGNMENT PROCEDURES

5.5.1 General

Two test procedures are included in this section; both are unique and designed to provide a specific function. The minimum performance test procedures are provided to ensure proper operation of the transponder before installation in the aircraft or after minor repairs have been completed. The detailed test and alignment procedures should be used when attempting to isolate faults and after repair has been made to realign the affected area. A bench test fixture must be fabricated to provide mode C code and to facilitate connection of the power supply to the transponder. Refer to figure 5-6 for a schematic diagram and parts list of the bench test fixture.

Figures 5-3 through 5-5 illustrate typical bench test setups which may be used to test and align the TDR-950/950L Transponder. The test setups shown are only guides and may be altered provided substituted equipment equals or exceeds the equipment listed in this section. Test and alignment procedures do not follow closely with a particular piece of test equipment; therefore, substitution of similar type units will not create difficulty in following test procedures. Ensure test equipment is properly calibrated and in good operating condition.

Warning

Voltages dangerous to life are present in the TDR-950/950L Transponder. Avoid contact with electrical circuits when performing tests.

5.5.2 Minimum Performance Test Procedure

5.5.2.1 Power Supply

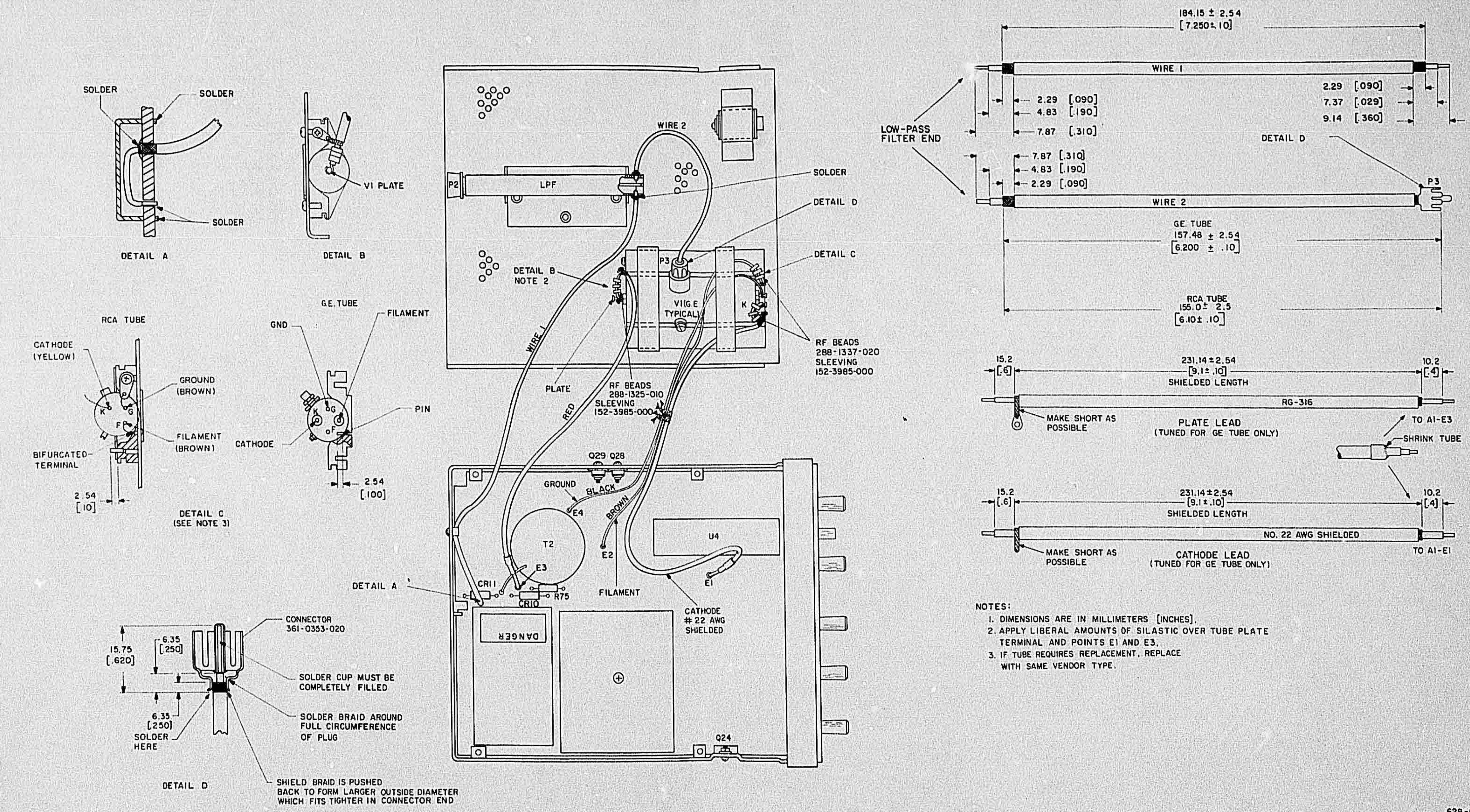
a. Connect power supply to bench test fixture and apply 13.75 V dc to TDR-950/950L.
b. Turn TDR-950/950L function switch to ON and allow at least 10 minutes for warmup.
c. Measure voltage at TP8. Result: 10 V dc +0.1 V -0.2 V.

5.5.2.2 Local Oscillator

Measure voltage at test point TP7. Result: 200 to 600 mV.

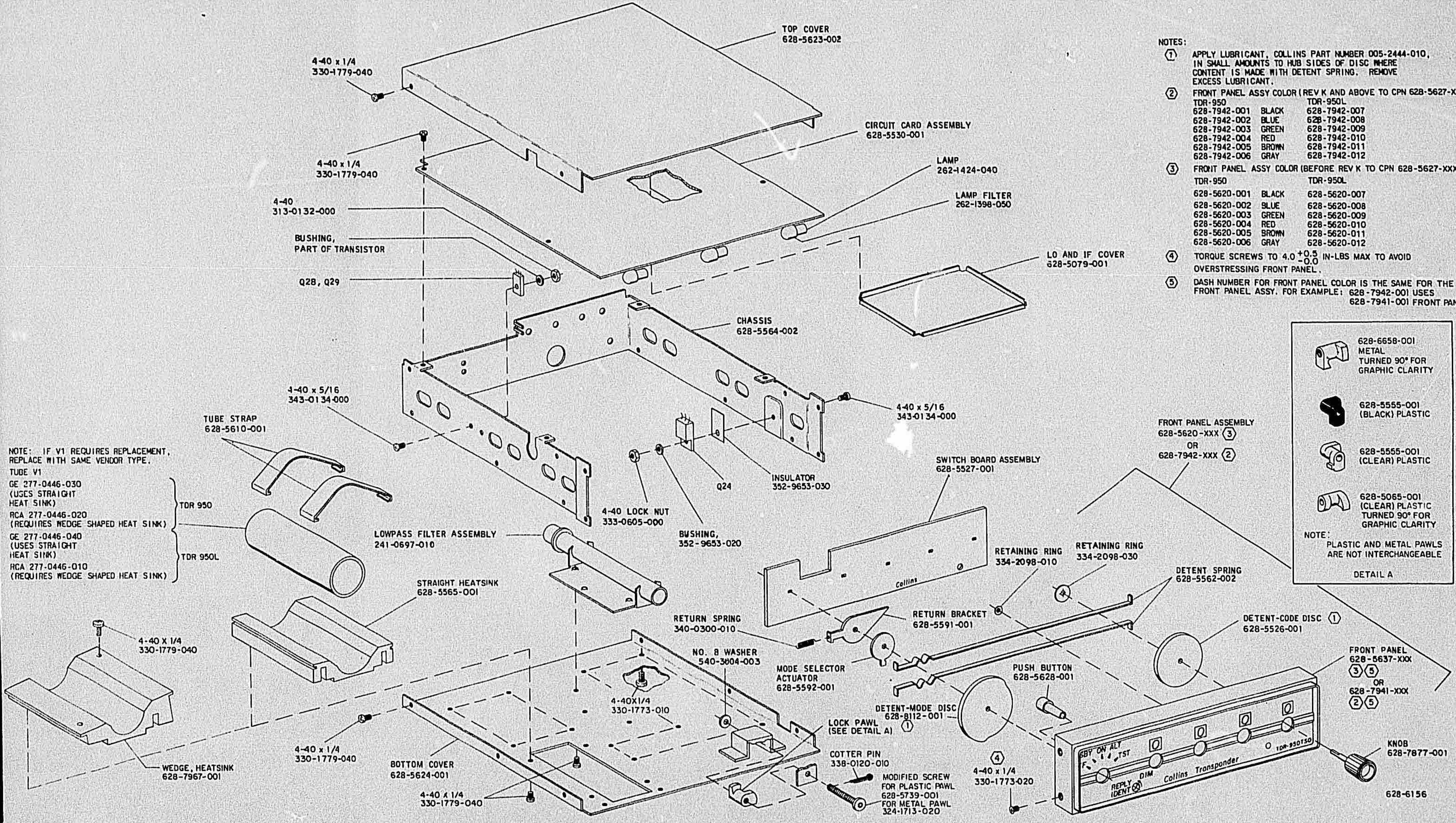
Table 5-3. Test Equipment Required.

EQUIPMENT	CHARACTERISTICS REQUIRED	REPRESENTATIVE TYPE
Transponder bench test set	Interrogation modes: A and C Side lobe suppression: P2 amplitude adjustable from 0 to -10 dB, P2 on/off Pulse deviation: P2, 2.0 ±0.7 μs; P3, 8.0 ±1.0 μs; or P3, 21.0 ±1.0 μs Pulse width: P1, P2, and P3 adjustable from 0.3 to 1.5 μs Interrogation prf: Repetitive adjustable 0 to 2000 p/s derived from crystal marker Reply efficiency Measured in p/s: 0 to 2000 ±1 percent Measured in percent: 0 to 100 ±1 percent Marker: 1.0 and 1.45 μs to ±0.01 percent spacing, phase adjustable Scope trigger: Sync pulse on P1 or P3 Rf generator Frequency: 1000 to 1090 MHz ±0.01 percent Power out: -10 dB mW to -110 dB mW ±0.5 dB Peak power measurement: 17 to 26 dB mW ±1/2 dB Frequency measurement: 0.01 percent accuracy	SQUAWK/NAUT I Kustom Instrument, IFR 1200Y3, or equivalent individual units capable of producing the characteristics required.
Power supply	14.0 V dc at 2 A	Any
Scope	0.05 to 20 V/cm vertical deflection 0.2 μs/cm to 1.0 ms/cm horizontal sweep speed Dc to 10-MHz response; external and internal triggering of sweep	HP 1710A
Digital voltmeter	0.000 to 28.000 V dc ±0.02 percent, 10-MΩ minimum impedance 1400 V dc ±5 percent, 10-MΩ minimum impedance	Fairchild 7000
Vom	0 to 10 V dc, 2000 ohms/V input impedance 0 to 50 V dc, 2000 ohms/V input impedance 0 to 250 V dc, 2000 ohms/V input impedance 0 to 2 A dc	Simpson 260
Analog or digital watch with seconds display	0 to 60 seconds with ±1 second accuracy	Any
TDR-950/950L bench test fixture	Provides mode C coding and connects power supply to transponder. Refer to figure 5-6.	Fabricate locally.
Test cover	Provides access to local oscillator and IF section for alignment. Refer to figure 5-7.	Fabricate locally.
Line stretcher	Characteristic impedance: 50 ohms. Adjustment range: 22 cm	General Radio 874-LK20L
or		
Ramp test set	Capable of measuring transponder output frequency to ±0.5 MHz.	



NOTES:
1. DIMENSIONS ARE IN MILLIMETERS [INCHES].
2. APPLY LIBERAL AMOUNTS OF SILASTIC OVER TUBE PLATE TERMINAL AND POINTS E1 AND E3.
3. IF TUBE REQUIRES REPLACEMENT, REPLACE WITH SAME VENDOR TYPE.

TDR-950/950L Transponder, Chassis Assembly
Figure 5-1



TDR-950/950L Transponder, Exploded View
Figure 5-2

NOTES:

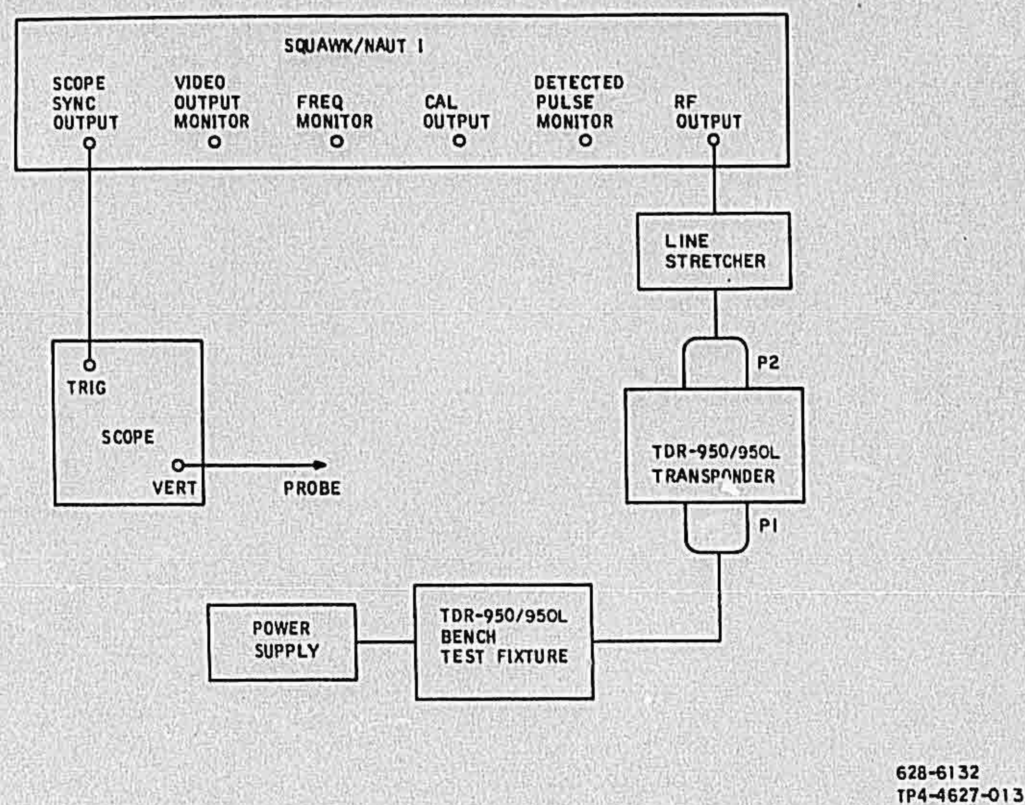
1. APPLY LUBRICANT, COLLINS PART NUMBER 005-2444-010, IN SMALL AMOUNTS TO HUB SIDES OF DISC WHERE CONTENT IS MADE WITH DETENT SPRING. REMOVE EXCESS LUBRICANT.
2. FRONT PANEL ASSY COLOR (REV K AND ABOVE TO CPN 628-5627-XXX)

TDR-950		TDR-950L
628-7942-001	BLACK	628-7942-007
628-7942-002	BLUE	628-7942-008
628-7942-003	GREEN	628-7942-009
628-7942-004	RED	628-7942-010
628-7942-005	BROWN	628-7942-011
628-7942-006	GRAY	628-7942-012

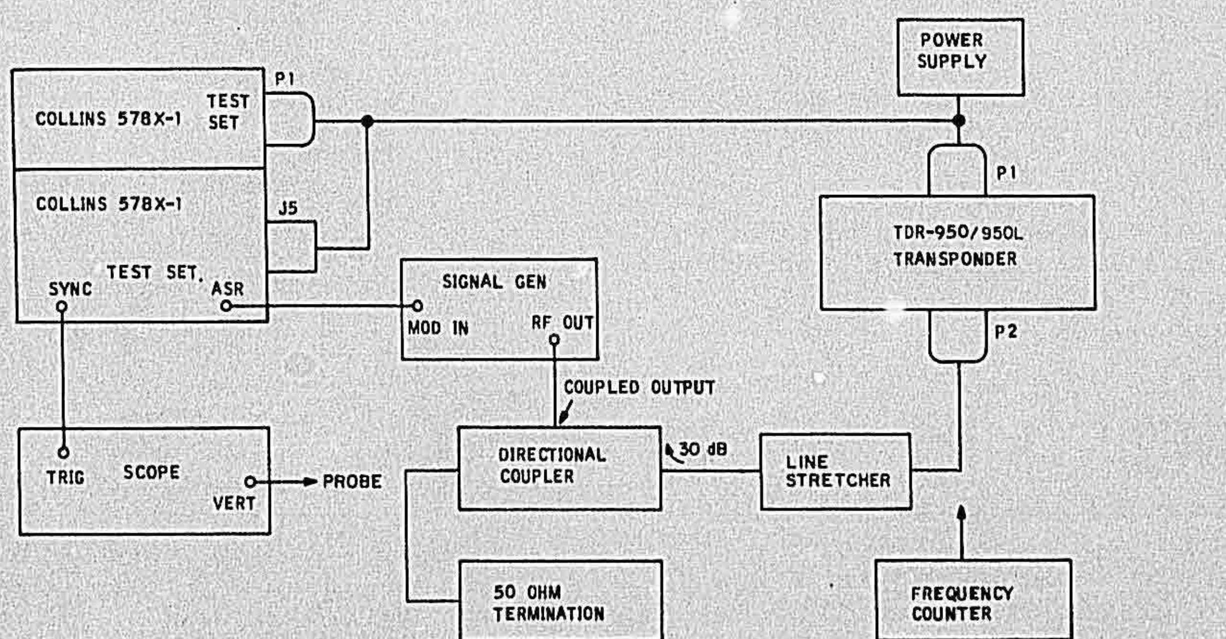
3. FRONT PANEL ASSY COLOR (BEFORE REV K TO CPN 628-5627-XXX)

TDR-950		TDR-950L
628-5620-001	BLACK	628-5620-007
628-5620-002	BLUE	628-5620-008
628-5620-003	GREEN	628-5620-009
628-5620-004	RED	628-5620-010
628-5620-005	BROWN	628-5620-011
628-5620-006	GRAY	628-5620-012

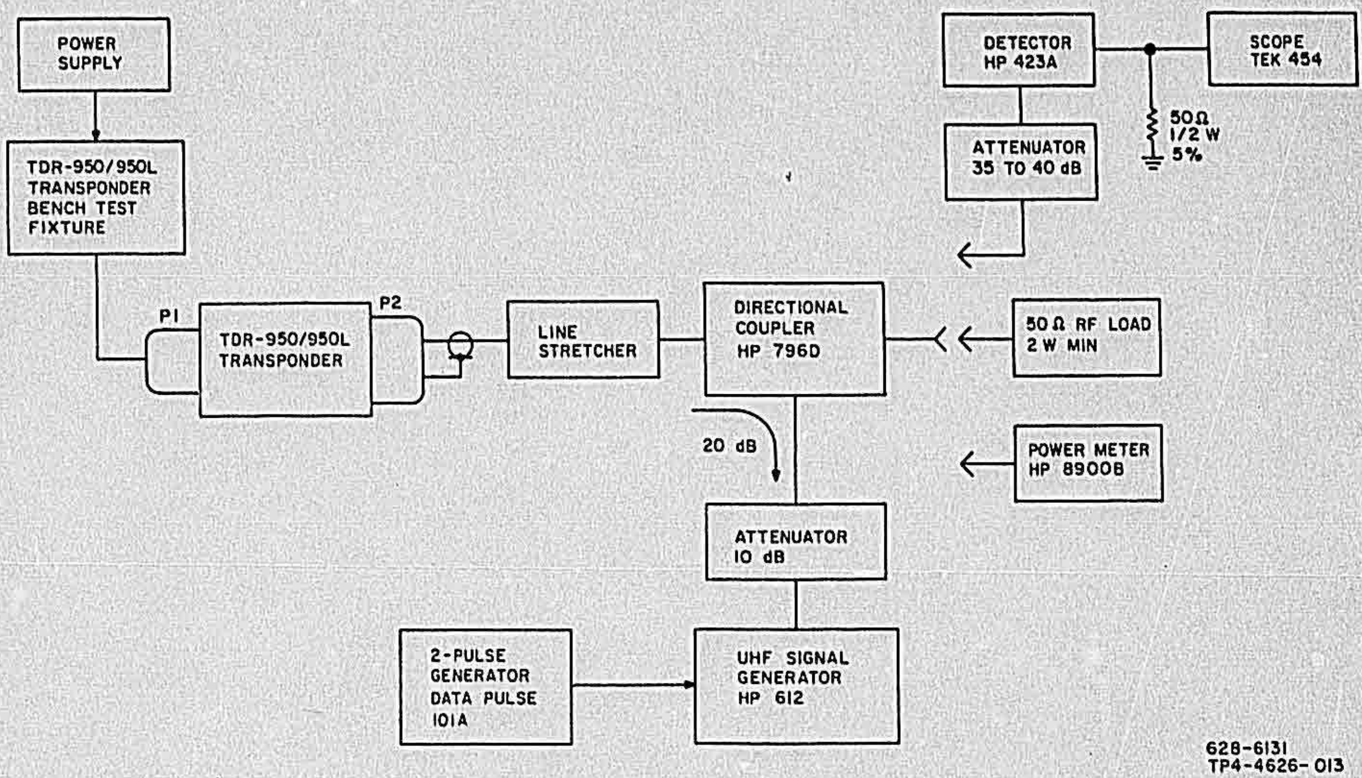
4. TORQUE SCREWS TO $4.0^{+0.5}_{-0.0}$ IN-LBS MAX TO AVOID OVERSTRESSING FRONT PANEL.
5. DASH NUMBER FOR FRONT PANEL COLOR IS THE SAME FOR THE FRONT PANEL ASSY. FOR EXAMPLE: 628-7942-001 USES 628-7941-001 FRONT PANEL.



Bench Test Setup Using SQUAWK/NAUT I
Figure 5-3



Bench Test Setup Using Collins 578X-1
Figure 5-4



Bench Test Setup Using Conventional Test Equipment
Figure 5-5

5.5.2.3 Minimum Trigger Level (MTL)

a. Generate a 2-pulse mode A interrogation at 500 interrogations per second. Adjust input power to obtain a 90-percent reply rate (450 replies per second). Result: Input power at -73 to -77 dB mW.
b. Generate a mode C interrogation, and vary the signal level until a 90-percent reply rate is obtained. Observe input level. Result: ±1 dB of the result obtained in step a.

5.5.2.4 Echo Recovery

a. Connect dc-coupled oscilloscope to echo ditch test point TP2.
b. Set mode C interrogation signal level to -71 dB mW (as seen at rf connector P2), and note peak voltage on scope.
c. Increase generator signal level to -24 dB mW and observe scope. Result: Negative going ramp intersects the voltage noted in step b, 15 to 16 microseconds after the waveform peak.

5.5.2.5 Mode A Decoder Aperture Check

a. With sls pulse off, set P1 to P3 pulse spacing to 7.8 microseconds. Generate a mode A interrogation at 500 interrogations per second.
b. Check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
c. Set P1 to P3 pulse spacing to 8.2 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
d. Set P1 to P3 pulse spacing to 7.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.
e. Set P1 to P3 pulse spacing to 9.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.

5.5.2.6 Mode C Decoder Aperture Check

a. With sls pulse off, set P1 to P3 pulse spacing to 20.8 microseconds. Generate a mode C interrogation at 500 interrogations per second.
b. Check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
c. Set P1 to P3 pulse spacing to 21.2 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
d. Set P1 to P3 pulse spacing to 20.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.
e. Set P1 to P3 pulse spacing to 22.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.

5.5.2.7 SLS Aperture Check

a. Generate a 3-pulse interrogation signal with P1 to P3 pulse spacing set to 8.0 microseconds. Adjust pulse P2 amplitude equal to P1 and P3.
b. Set P1 to P2 pulse spacing to 1.30 microseconds. Check reply rate at -71-, -50-, and -24-dB mW input levels. Results: Reply rate not less than 90 percent.
c. Set P1 to P2 pulse spacing to 1.85 microseconds. Check reply rate at -24-, -50-, and -71-dB mW input levels. Results: Reply rate not more than 1 percent.
d. Set P1 to P2 pulse spacing to 2.20 microseconds. Check reply rate at -71-, -50-, and -24-dB mW input levels. Results: Reply rate not more than 1 percent.
e. Set P1 to P2 pulse spacing to 2.70 microseconds. Check reply rate at -24-, -50-, and -71-dB mW input levels. Results: Reply rate not less than 90 percent.

5.5.2.8 SLS Amplitude Discrimination

a. Set P1 to P2 pulse spacing to 2.0 microseconds. Adjust P2 level below P1 level until a 90-percent reply rate is obtained.
b. Connect scope to test point TP1 and establish an amplitude relationship between P1 and P2.
c. For P1 to P3 input levels of -73, -50, and -24 dB mW, measure the relative level of P2. Results: P2 is not more than 9 dB down from P1.

5.5.2.9 Reply Parameter Check

a. Set generator for a mode A interrogation at -25 dB mW. Connect scope channel 1 to video monitor output (detected video) and channel 2 to 1.45-microsecond markers.
b. Adjust scope for a delayed sweep of 0.5 microsecond per unit, and view alternate channel sweeps. Results: F1 and F2 pulses are present, and leading edge spacing is 20.3 microseconds ±40 nanoseconds.
c. Set TDR-950/950L code select switches to 0000 and observe scope. Results: Only F1 and F2 appear in transmitter output.
d. Set code select switches to 7777 and observe scope. Results: All 14 pulses appear in transmitter output.
e. Check reply pulse position error with code selector switches set to 7777. Results: Position error less than 45 nanoseconds for each pulse. Refer to table 5-4.

Note

Measurement of the transmitter output frequency may be checked using several different methods. The best results and most accurate measurement will be obtained by checking the output frequency with the transponder installed in the aircraft. Using this method, any change in transmitter output frequency due to installation VSWR can be compensated for during adjustment. A ramp test set capable of checking the transponder output frequency to ±0.5 MHz is required for an in-the-aircraft test.

When a ramp test set is not available or bench testing is required, checking the transmitter reply frequency requires a bench test setup with a known VSWR not greater than 1.1:1. If the bench VSWR is not known or exceeds 1.1:1, a line stretcher must be used. Using a line stretcher, check the output frequency as follows:

1. Connect the transponder to the test equipment as shown in figure 5-3, 5-4, or 5-5.
2. Interrogate the transponder with a -25-dB mW mode A signal and allow at least 10 minutes for stabilization.
3. While observing the transmitter output frequency, carefully adjust the line stretcher until the highest possible output frequency is obtained. Record this frequency and designate as f_H.

4. Adjust the line stretcher to obtain the lowest possible frequency. Record this frequency and designate as f_L.
5. Compute $(f_H + f_L)\ 1/2 = f_C$. If f_C is ±2 MHz or greater from 1090 MHz, refer to the detailed test and alignment procedures for transmitter frequency adjustment.

f. Measure transmitter output frequency. Results: 1090 ±2 MHz.
g. Depress TDR-950/950L IDENT button and observe scope. Results: Identification pulse is present at 24.65 microseconds ±60 nanoseconds.
h. Measure transmitter peak output power. Results: TDR-950: 200 watts minimum. TDR-950L: 112 watts minimum.

5.5.2.10 Mode C Reply Check

a. Set generator for mode C interrogation at -25 dB mW.
b. Enable all altitude code select switches on TDR-950/950L bench test fixture.
c. Set TDR-950/950L function select switch to ON, and observe reply output. Results: Only framing pulses F1 and F2 appear in reply.
d. Connect channel 2 of scope to 1.45-microsecond markers, and turn TDR-950/950L function selector switch to ALT. Observe scope. Results: All 10 altitude information pulses appear in the correct position ±40 nanoseconds.

5.5.2.11 Ident Duration Check

a. Set generator for mode A interrogation at -25 dB mW. Connect scope to video monitor output (detected video).
b. Using a stop watch or clock with second hand, measure the time interval beginning at release of IDENT button to disappearance of identification pulse from reply. Result: 15 to 30 seconds.

5.5.2.12 Reply Lamp Check

a. Set generator for mode A interrogation at 500 interrogations per second, -25 dB mW. Rotate IDENT/dimmer button, and check for smooth operation and uniform dimming.
b. Rotate IDENT/dimmer for maximum brightness. Reduce input signal level to -80 dB mW, and observe reply lamp. Results: Reply lamp is off.

Note

If generator cannot be adjusted down to 20 interrogations per second, increase P2 amplitude (sls pulse) to obtain 20 replies per second. An alternative method is to connect an oscilloscope to Q30 collector and measure the negative-going pulse width; pulse width must exceed 50 milliseconds.

c. Increase input level to -60 dB mW and reduce interrogation rate to 20 interrogations per second. Observe reply lamp. Results: Reply lamp shows steady and complete illumination.
d. Reduce input signal level to -80 dB mW. Push IDENT button and observe reply lamp. Results: Reply lamp shows steady and complete illumination.
e. Rotate IDENT button and check for smooth rotation and proper dimming action.

Table 5-4. Pulse Spacing Reference Points.

PULSE	PULSE POSITION (ns)
F1 (first framing)	0 (reference point)
C1	1.45 ±40
A1	2.90 ±40
C2	4.35 ±40
A2	5.80 ±40
C4	7.25 ±40
A4	8.70 ±40
B1	11.60 ±40
D1	13.05 ±40
B2	14.50 ±40
D2	15.95 ±40
B4	17.40 ±40
D4	15.85 ±40
F2 (second framing)	20.30 ±40
SPIP	24.65 ±40

5.5.2.13 Reply Rate Limit

a. Set generator for mode A interrogation at 1200 interrogations per second, -71 dB mW. Observe reply rate. Results: 1080 replies per second minimum.
b. Increase input signal level to -44 dB mW, and increase interrogation rate to 2000 per second. Observe reply rate. Results: 1800 replies per second maximum.

5.5.2.14 Self-Test

a. Set generator for mode A interrogation, -100 dB mW or less.
b. Rotate TDR-950/950L function select switch to TST and observe reply lamp. Results: Reply lamp shows steady and complete illumination while function selector switch is held in the TEST position.

Note

If any of the preceding tests do not yield the correct results, refer to the detailed test and alignment procedures of paragraph 5.5.3.

5.5.2.15 Incoming Suppression

Note

The following test procedure is applicable only to those TDR-950/950L Transponders that have service bulletins 1 or 9 installed.

ERRATA SHEET 1 TO MAINTENANCE SECTION
FOR
TDR-950/950L TRANSPONDER INSTRUCTION BOOK

(523-0766469-006118, dated 1 August 1984)
(Located in instruction book 523-0766464-00411A)

This errata sheet is being issued to correct the pulse position reference point for pulse D4 shown in table 5-4 of test step 5.5.2.12 on page 5-10.

Insert this errata sheet adjacent to page 5-10 of the maintenance section.

Make the following change to table 5-4:

The right hand column of table 5-4 should specify pulse D4 position as 18.85 ±40 ns rather than 15.85 ±40 ns.

a. Set generator for a mode A interrogation at 500 interrogations per second. Increase input power until a 90-percent reply rate is obtained.
b. Connect an external dc voltage source to P1-2(+) and P1-1(−). Starting at 0 volts, increase the voltage until a +5.0 V dc level is obtained and verify that transponder replies are suppressed.
c. Adjust voltage source to +1.0 V dc and verify that transponder is no longer suppressed.

5.5.3 Detailed Test and Alignment Procedures

5.5.3.1 Power Supply

a. Connect TDR-950/950L to test equipment and turn function selector switch to SBY.
b. Monitor voltage at regulator test point TP8. Results: +10.0 V dc ±50 mV. If necessary, adjust R70 until results are obtained.
c. Set primary input voltage to 11.0 V dc, and observe voltage present at test point TP8. Results: 10 V dc +0.1 V, -0.2 V.
d. Set primary input voltage to 17.0 V dc, and observe voltage present at test point TP8. Results: 10 V dc +0.1 V, -0.2 V.
e. Set primary input voltage to 13.75 V dc ±5 percent, and measure voltage at collector (case) of transistor Q16. Results: 4.65 to 5.35 V dc.
f. Measure voltage at test point TP9. Results: -11.4 to -12.6 V dc.

Warning

Use extreme caution when measuring voltage in step g.

g. Measure voltage at transmitter V1 plate (E3). Results: 1275 to 1425 V dc (can be measured at C49).
h. Measure transmitter filament voltage (E2) using scope or true rms voltmeter. Results: 12 to 13.3 volts peak to peak or 5.98 to 6.62 volts rms.

5.5.3.2 Local Oscillator

5.5.3.2.1 PC Board 628-5531-001 REV's A Through J/Assembly 628-5530-001 REV's A Through X

a. Remove local oscillator/IF enclosure shield, and replace with test cover. Refer to figure 5-7 for fabrication details.

Note

Adjustment of L1 and L4 must be made using a nonmetallic tool. A wooden or plastic dowel with a flattened end is recommended.

b. Adjust L1, L4, and Z4 for maximum mixer current. Results: 2.0 mA minimum (200 mV at TP7R).

Note

Inductor L1 must be carefully adjusted. As its length is shortened, mixer current will increase to a point beyond which current may drop off to zero. L1 should be adjusted (spread) to provide 90 to 100 percent of peak mixer current.

c. Turn TDR-950/950L function selector switch to OFF, then back to ON, to ensure local oscillator starts properly.

5.5.3.2.2 PC Board 628-5531-001 REV K and Above/Assembly 628-5530-001 REV Y and Above

a. Remove local oscillator/IF enclosure shield, and replace with test cover. Refer to figure 5-7 for fabrication details.

Note

Adjustment of L1 and L4 must be made using a nonmetallic tool. A wooden or plastic dowel with a flattened end is recommended.

b. Adjust L1, L4, and Z4 for maximum mixer current. Result: 2.0 mA minimum (200 mV at TP7R).

Note

Inductor L1 must be carefully adjusted. As its length is increased, mixer current will increase to a point beyond which current may drop off to zero. L1 should be adjusted (compressed) to provide 90 to 100 percent of peak mixer current.

c. Turn TDR-950/950L function selector switch to OFF, then back to ON, to ensure local oscillator starts properly.

5.5.3.3 Intermediate Frequency Section

a. Set the interrogation signal generator to 1030 MHz, -30 dB. Connect dc-coupled scope to video test point TP1, and set scope for 1 volt/cm vertical, 2 μs/cm horizontal.

Note

The preselector contains resonators that are tuned to provide a flat response at the band-pass frequency and a sharp loss at all other frequencies. Although adjustment of the preselector resonators (Z1 through Z3) is rarely required, care must be taken when adjustment is needed to ensure minimal 1030-MHz attenuation. Improper adjustment of Z1 through Z3 may result in amplitude response reduced by as much as 30 dB at a secondary response peak. When adjusting preselector resonators, be sure that maximum amplitude pulses are obtained at TP1 while doing final adjustment at -70-dB mW input power level. Normally, only minimal rotation of these adjustment screws is required for peak amplitude.

b. With test cover secured in place (refer to figure 5-7), adjust Z1, Z2, Z3, T1, L6, and L7 for maximum video signal amplitude.
c. Reduce generator input level to -70 dB mW, and repeat step b.
d. Finally, readjust Z4 and Z3 for maximum video signal amplitude.
e. Vary the generator input level from -75 to -20 dB mW while monitoring video signal on scope. Check for normal pulse shape, absence of limiting, and any indication of instability such as baseline shift.
f. If the results described in step e are not obtained, repeat steps a through e.
g. Verify crystal control of local oscillator by slightly varying the length of L1 while monitoring video at TP1 with -70-dB mW signal applied. Result: Video amplitude and pulse shape must not change.

5.5.3.3A Gain Adjustment (Board REV AN and above)

a. Set R66 to midposition.
b. Adjust signal level to -70 dB mW with mode A interrogation at 500 interrogations per second.
c. Adjust R66 for approximately 0.8 V p-p of video output measured at TP1.

5.5.3.4 Minimum Trigger Level (MTL)

a. Set generator for mode A interrogation at 500 interrogations per second, -74 dB mW (as measured at TDR-950/950L rf connector P2).
b. Allow at least 10 minutes for warmup, then monitor reply rate and adjust MTL ADJUST R30 to provide a 90-percent reply rate (450 replies per second).
c. Change interrogation to mode C, and adjust input signal level until 450 replies per second is obtained. Observe generator input level. Results: -74 dB mW ±0.5 dB (taken at TDR-950/950L rf connector P2).

Note

When properly adjusted, clockwise rotation of R30 decreases sensitivity (increases MTL).

5.5.3.5 Echo Recovery

a. Connect dc-coupled scope to echo ditch test point TP2. Adjust generator signal to -71 dB mW (as seen at TDR-950/950L rf connector P2), and note peak voltage on scope.
b. Increase input signal level to -24 dB mW, and adjust R24 until negative going ramp intersects the voltage noted in step a, 15 microseconds after the waveform peak at trailing edge.

5.5.3.6 Mode A Decoder Aperture Check

a. With sls pulse off, set P1 to P3 pulse spacing to 7.8 microseconds. Generate a mode A interrogation at 500 interrogations per second.
b. Check reply rate for each of the following input signal levels: -71, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
c. Set P1 to P3 pulse spacing to 8.2 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
d. Set P1 to P3 pulse spacing to 7.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.
e. Set P1 to P3 pulse spacing to 9.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.
f. If results of the preceding steps are not obtained, perform the decoder-encoder U4 operational checks of paragraph 5.5.3.16.

5.5.3.7 Mode C Decoder Aperture Check

a. With sls pulse off, set P1 to P3 pulse spacing to 20.8 microseconds. Generate a mode C interrogation at 500 interrogations per second.
b. Check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
c. Set P1 to P3 pulse spacing to 21.2 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is greater than 90 percent (450 replies per second) for each input level.
d. Set P1 to P3 pulse spacing to 20.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.
e. Set P1 to P3 pulse spacing to 22.0 microseconds, and check reply rate for each of the following input signal levels: -74, -50, and -25 dB mW. Results: Reply rate is less than 10 percent (50 replies per second) for each input level.
f. If the results of the preceding steps are not obtained, perform the decoder-encoder U4 operational checks of paragraph 5.5.3.16.

5.5.3.8 SLS Aperture Check

a. Generate a 3-pulse interrogation signal with P1 to P3 pulse spacing set to 8.0 microseconds. Adjust P2 amplitude equal to P1 and P3.
b. Set the generator interrogation level to -70 dB mW and reduce P1 to P2 pulse spacing from 2 microseconds until a 90-percent reply rate is obtained. Record P1 to P2 pulse spacing at this point.
c. Increase P1 to P2 pulse spacing upward from 2 microseconds until a 90-percent reply rate is obtained. Record P1 to P2 pulse spacing.

Note

Changing the test select value of C29 as described in step d should only be done after replacement of decoder-encoder U4.

d. If the pulse spacings recorded in steps b and c are not within 1.3 to 2.7 microseconds, change the value of test select capacitor C29. Selected values of C29 are: 10 pF, 22 pF, 36 pF, or complete removal.

Note

Increasing the value of test select capacitor C29 will increase the pulse spacings measured above by approximately 4 nanoseconds per picofarad. Should the value of C29 be changed, both mode A and mode C decode aperture checks must be repeated. Refer to paragraphs 5.5.3.6 and 5.5.3.7.

e. Set P1 to P3 pulse spacing to 1.30 microseconds. Check reply rate at -72-, -50, and -25-dB mW input levels. Result: Reply rate is less than 90 percent.
f. Set P1 to P2 pulse spacing to 1.85 microseconds. Check reply rate at -25-, -50-, and -72-dB mW input levels. Result: Reply rate not more than 1 percent.
g. Set P1 to P2 pulse spacing to 2.20 microseconds. Check reply rate at -71, -50, and -24 dB mW. Result: Reply rate is not more than 1 percent.
h. Set P1 to P2 pulse spacing to 2.70 microseconds. Check reply rate at -24, -50, and -71 dB mW. Result: Reply rate not less than 90 percent.
i. If results of the preceding steps are not obtained, perform the decoder-encoder U4 operational check of paragraph 5.5.3.16.

5.5.3.9 SLS Amplitude Discrimination

a. Set P1 to P2 pulse spacing to 2.0 microseconds. Adjust P2 level below P1 level until a 90-percent reply rate is obtained.
b. Connect scope to test point TP1, and establish an amplitude relationship between P1 and P2.
c. For P1 to P3 input levels of -73, -50, and -24 dB mW, measure the relative level of P2. Result: P2 not more than 9 dB down from P1.

Note

If P2 is greater than 9 dB mW down from P1 at -25 dB mW, decrease test select capacitor C24 to next smaller value. This procedure should not be performed unless key IF components such as U1 or U2 are replaced.

5.5.3.10 Reply Parameter

Note

Measurement of the transmitter output frequency may be checked using several different methods. The best results and most accurate measurement will be obtained by checking the output frequency with the transponder installed in the aircraft. Using this method, any change in transmitter output frequency due to installation VSWR can be compensated for during adjustment. A ramp test set capable of checking the transponder output frequency to ±0.5 MHz is required for in-the-aircraft testing and alignment.

When a ramp test set is not available or bench testing is required, checking the transmitter reply frequency requires a bench test setup with a known VSWR not greater than 1.1:1. If the bench VSWR is not known or exceeds 1.1:1, a line stretcher must be used. Using the line stretcher, check and adjust the output frequency as follows:

1. Connect the transponder to the test equipment as shown in figure 5-3, 5-4, or 5-5.
2. Interrogate the transponder with a -25-dB mW mode A signal and allow at least 10 minutes for warmup and stabilization.
3. While observing the transmitter output frequency, carefully adjust the line stretcher until the highest possible output frequency is obtained. Record this frequency and designate as f_H.
4. Adjust the line stretcher to obtain the lowest possible frequency. Record this frequency and designate as f_L.
5. Compute $(f_H + f_L)\ 1/2 = f_C$. If f_C (center frequency) is less than 1089.7 MHz, rotate V1 frequency adjustment counterclockwise slightly and repeat steps 3 and 4. If f_C is greater than 1090.3 MHz, rotate V1 frequency adjustment clockwise and repeat steps 3 and 4.

a. Set generator for mode A interrogation, -25 dB mW. Connect scope channel 1 to video monitor output detected video) and channel 2 to 1.45-microsecond markers.
b. Adjust scope for a delayed sweep of 0.5 microsecond per unit, and view alternate channel sweeps. Only framing pulses F1 and F2 should be present. Observe leading edge spacing of F1 and F2. Results: 20.30 microseconds ±20 nanoseconds. If necessary, adjust L8 until results are obtained.

Note

Should L8 be found defective during troubleshooting, the modification plate must be checked to see if SB 5 has been installed. If SB 5 has not been installed, refer to that document and perform the modification procedure described. If SB 5 has been installed, replace L8 using normal replacement procedures.

c. Observe transmitter pulse width. Results: 0.45 microsecond ±20 nanoseconds. If necessary, adjust R44 until result is obtained.
d. Rotate TDR-950/950L code selector switches to 7777 and observe transmitter output. Results: Output contains all 14 pulses with pulse position error less than ±45 nanoseconds. Refer to table 5-4.
e. Observe transmitter output frequency. Result: 1090 MHz ±2.0 MHz. If necessary, adjust transmitter output frequency by rotating V1 tuning screw until the proper frequency is obtained.

Note

The transmitter tube, V1, may have a locking nut which must be loosened prior to adjustment. Before attempting to loosen this nut, ensure all power is off. After adjustment, retighten the locknut with power off, and check the transmitter output to ensure the tuning screw was not disturbed during tightening.

f. Depress the IDENT button, and verify identification pulse is located 24.65 microseconds ±40 nanoseconds from F1 leading edge.
g. Measure transmitter peak power output. Result: 200 watts minimum (112 watts minimum TDR-950L).

Caution

The J3 phono plug receptacle, which is an integral part of transmit tube V1, is vendor installed and should never be tampered with in the field or on the bench in an attempt to increase output power. Rotation of this receptacle may produce modest increases in output power; however, the transmitter output frequency will change drastically making it necessary to realign the transmitter. Even though the output frequency may be brought back to the 1090-MHz center frequency on the bench after J3 rotation, clockwise rotation of J3 greatly increases the susceptibility to frequency pulling caused by small changes in vswr. Reinstallation of the transponder in the aircraft will therefore result in an output frequency change. The amount of change, or frequency pulling, will be proportional, and extremely sensitive to small changes in system vswr. In fact, coaxial cable aging and/or accumulation of oil, ice, or contaminants of any kind on the transponder antenna will result in a vswr change of sufficient magnitude to pull the transponder off frequency.

If, when measuring the transmitter power output (refer to service information letter 5-76), a below normal output is obtained, do not rotate J3. Check to see if filament and plate voltages are the correct amplitude, modulator pulsing is present on the cathode, and a solid ground is made between the cavity and the main printed circuit board. If all of these inputs are normal, replace V1.

When a defective cavity is detected and replaced in a transponder under warranty per existing Avionics Warranty Claim Policy Dealer Letter No. 142, the defective cavity must be returned to your regional customer service representative.

h. Measure Q19 collector voltage using an oscilloscope. Maximum value is 100 V peak.

5.5.3.11 Mode C Reply

a. Set generator for mode C interrogation at -25 dB mW.
b. Set TDR-950/950L function selector switch to ON, and enable all altitude code select switches on the bench test fixture. Observe reply output. Results: Only framing pulses F1 and F2 appear in output.
c. Connect channel 2 of scope to 1.45-microsecond markers, and turn TDR-950/950L function selector switch to ALT. Observe scope. Results: All 10 altitude information pulses appear in the correct position ±100 nanoseconds.
d. If the results of the preceding steps are not obtained, perform the decoder-encoder U4 operational checks of paragraph 5.5.3.16.

5.5.3.12 IDENT Duration

a. Set generator for mode A interrogation at -25 dB mW. Connect scope to video monitor output (detected video).
b. Using a stopwatch or clock with second hand, measure the time interval beginning at the release of IDENT button to disappearance of identification pulse from reply. Results: 15 to 30 seconds.

5.5.3.13 Reply Lamp

a. Set generator for mode A interrogation at 500 interrogations per second, -25 dB mW. Rotate IDENT/dimmer button, and check for smooth operation and uniform dimming.
b. Rotate IDENT/dimmer for maximum brightness. Reduce input signal level to -80 dB mW, and observe reply lamp. Result: Reply lamp is off.

Note

If test set cannot be adjusted down to 20 interrogations per second, increase P2 amplitude (sls pulse) to obtain 20 replies per second. An alternate method is to connect an oscilloscope to Q30 collector and measure the negative-going pulse width; pulse width must exceed 50 milliseconds.

c. Increase input level to -60 dB mW and reduce interrogation rate to 20 interrogations per second. Observe reply lamp. Result: Reply lamp shows steady and complete illumination.
d. Reduce signal input level to -80 dB mW. Push IDENT button, and observe reply lamp. Result: Reply lamp shows steady and complete illumination.
e. Rotate IDENT button and check for smooth rotation and proper dimming action.

5.5.3.14 Reply Rate Limit

a. Set generator for mode A interrogation at 1200 interrogations per second, -72 dB mW. Observe reply rate. Result: 1080 to 1150 replies per second. If necessary, rotate REPLY RATE LIMIT ADJUST R64 until approximately 1100 replies per second are obtained.
b. Increase interrogation rate to 2000 replies per second at -44 dB mW and observe reply rate. Result: 1800 replies per second maximum.

5.5.3.15 Self-Test

a. Set generator for mode A interrogation, -100 dB mW or less.

b. Set TDR-950/950L function selector switch to TST and observe reply lamp. Result: Reply lamp shows steady illumination while function selector switch is held in TST position.

5.5.3.16 Incoming Suppression

Note

The following test procedure is applicable only to those TDR-950/950L Transponders that have service bulletins 1 or 9 installed.

a. Generate a 2-pulse mode A interrogation at 500 interrogations per second. Increase the input power until a 90-percent reply rate is obtained.
b. Connect an external dc voltage source to P1-2(+) and P1-1(-). Adjust the voltage source for +5.0 V dc and verify that transponder replies are suppressed.
c. Adjust voltage source to +1.0 V dc and verify that transponder is no longer suppressed.

5.5.3.17 Decoder-Encoder U4 Operational Check

Note

The following checks need only be made if difficulty is experienced in obtaining the results of preceding tests.

a. Check decoder clock generator output at U4, pins 32 and 33, for a 3.00-MHz, 180-degree out-of-phase relationship. Excursion should be at least +4 to -10 volts.
b. Verify pulses at U4, pins 8 and 39, are normal (represent a valid interrogation or sls interrogation).
c. Ensure voltages at U4, pins 1 and 7, are within ±5 percent, and a solid ground is present at U4, pin 6.
d. Voltages at U4, pins 35, 36, and 38 must be +3.5 volts or greater.
e. Verify correct encoder clock pulses are present at U4, pin 9 (assuming correct GATE output).
f. If all the conditions described in steps a through e are normal, replace decoder-encoder U4.

5.5.3.18 28-Volt Power Interrupt

Note

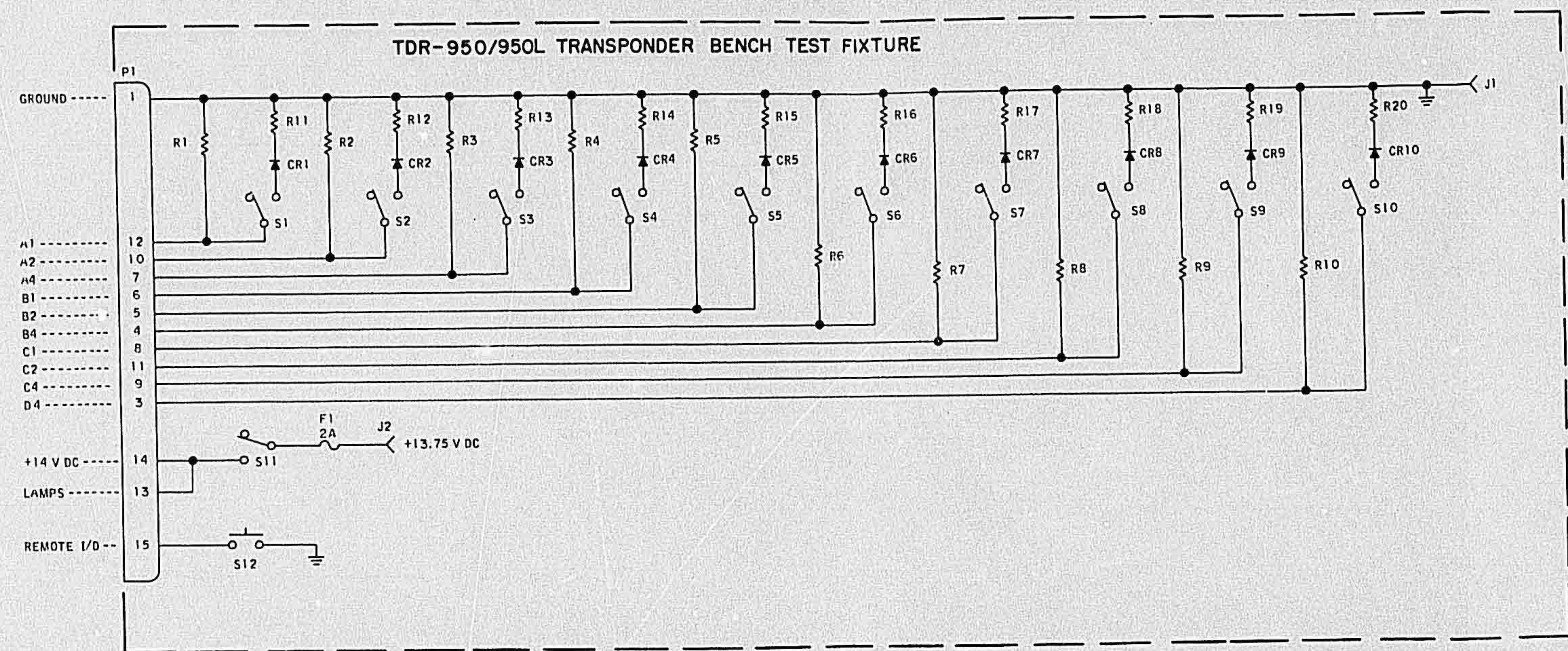
The following test procedures are applicable to transponders installed in 27.5-volt systems only.

a. Apply +28 V dc to a 12-ohm, 30-watt resistor and connect in series with J1, pin 14. Turn the transponder on and allow for warmup and stabilization.
b. Interrogate the transponder with a mode A -25-dB mW signal. Connect scope channel 1 to video monitor output (detected video) and channel 2 to 1.45-microsecond markers.
c. Adjust the scope for a delayed sweep of 0.5 microsecond per unit, and view alternate channel sweeps. Results: F1 and F2 pulses are present, and leading edge spacing is 20.3 microseconds ±20 nanoseconds.
d. Note power supply input current level and record for future reference.
e. Reduce power supply voltage from 28 volts to 20 volts, then turn the power off for about 1 second. Reapply power after 1-second duration has elapsed. Increase the supply voltage to 24 volts and compare input current to that recorded in step d. If current drain is different, record the new value.
f. Measure the voltage present on the +10-V dc bus and record.
g. Observe the transmitter output power and pulse shape.

Note

The input power interrupt may reinitiate the power-on delay and inhibit reply pulses for 20 seconds or so; this is normal.

h. If an increase in input current is detected, +10-V dc bus voltage is low, or the transmitter output is low and erroneous pulses are detected, the failure mode has been verified and Service Bulletin No 7 should be installed. If the bulletin has already been installed, U3 should be replaced. After U3 replacement, repeat the entire testing procedure to ensure the transponder is operating normally.



BENCH TEST FIXTURE PARTS LIST

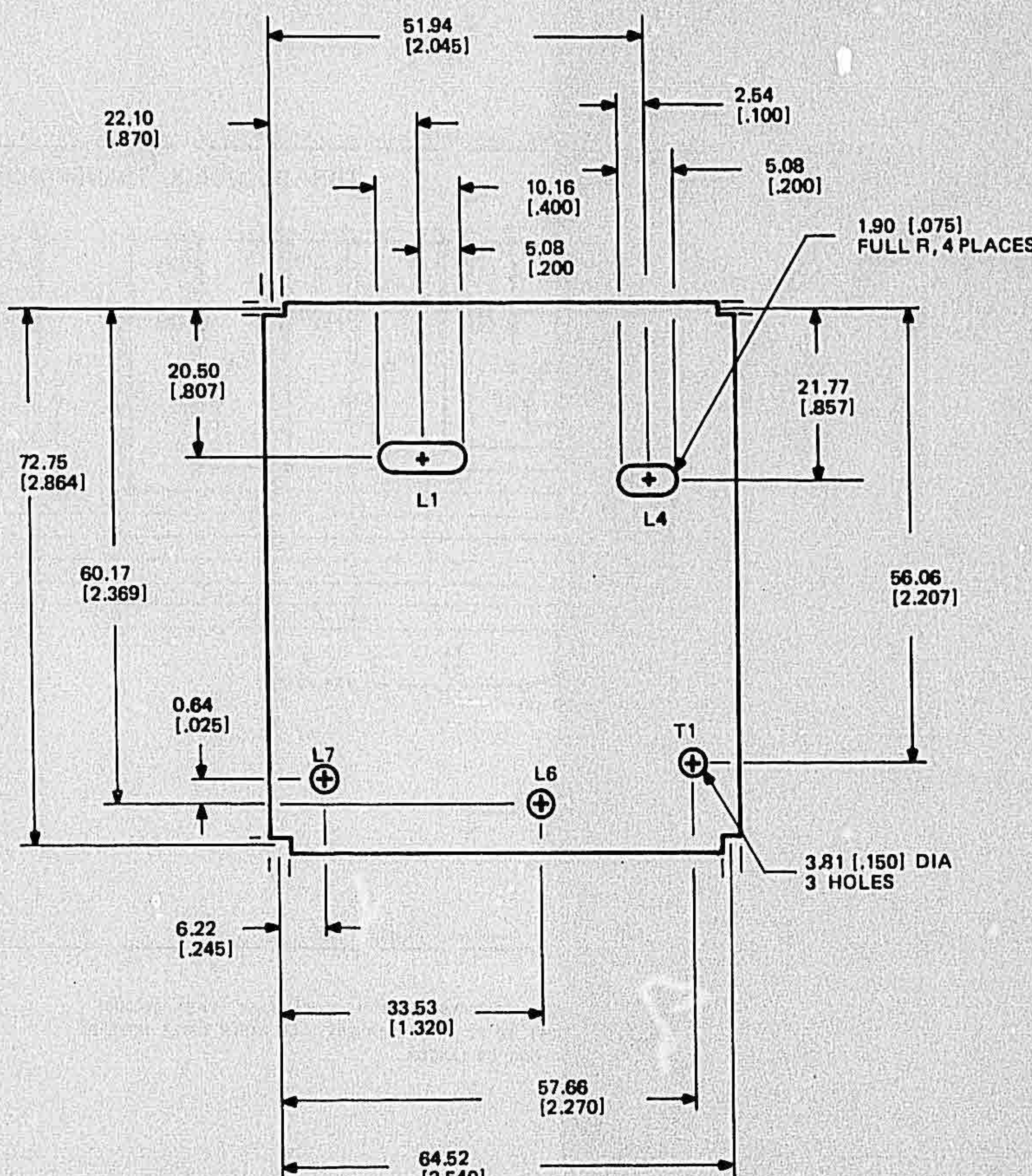
REF	DESCRIPTION
CR1-CR10	DIODE, 1N4454.
F1	2.0 A FUSE OR CIRCUIT BREAKER.
P1	UNIT CONNECTOR: CPN 372-7513-080
	CONTACTS FOR J1: CPN 372-7513-200
J1, J2	BANANA PLUG JACK.
R1-10	RESISTOR, FIXED, 47 KILOHM ±5%, 1/4 W.
R11-R20	RESISTOR, FIXED 470 OHM ±5%, 1/4 W.
S1-S11	SWITCH, SPST TOGGLE OR ROTARY.
S12	SWITCH, N.O. PUSHBUTTON.

NOTES:

1. WIRES CARRYING +13.75 V DC (INCLUDING POWER GROUND) MUST BE 22 AWG OR LARGER. ALL OTHER WIRES MUST BE 24 AWG OR LARGER.

628-6123
TP4-4521-014

TDR-950/950L Transponder, Bench Test Fixture
Figure 5-6



NOTES:

1. TEST COVER IS MODIFIED LO & IF COVER. COLLINS PART NUMBER 628-5079-001.
2. DIMENSIONS ARE IN MILLIMETRES [INCHES].

628-6133
TP4-4628-011

TDR-950/950L Transponder, LO and IF Test Cover
Figure 5-7

Collins TDR-950/950L Transponder

Rockwell International

diagrams

Diagrams

TDR-950/950L

523-0766470-005118

Collins General Aviation Division

Printed in USA

523-0766470-005118
5th Edition, 1 August 1984

list of illustrations

NOTICE: This section replaces fourth edition dated 2 October 1978.

Record of Revisions

RETAIN THIS RECORD IN THE FRONT OF MANUAL.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER INCLUDED
1st Ed	1 Sep 75		None				
2nd Ed	1 Apr 76		1-75 thru 4-75, 1-76 SB 1, 2				
3rd Ed	15 Sep 76		Those listed plus SB 3, 4 SIL 2-76 thru 4-76				
4th Ed	2 Oct 78		Those listed plus SB 5, 6, 7, 8; SIL 5-76; SIL 1-77 thru 3-77; SIL 1-78, 2-78				
5th Ed	1 Aug 84	S.L. 12/21/84	Those listed plus SB 9, 10R SIL 1-79, 2-82				

AIRCRAFT TECHNICAL PUBLISHERS

ATP RECORD OF TEMPORARY REVISIONS

TEMP. REV. NO.	SECTION: PAGE NUMBER	ISSUE DATE	ATP REV. DATE	BY	DATE REMOVED	ATP GRID

List of Effective Pages

*The asterisk indicates pages changed, added, or deleted by the current change.

Page No	Issue
*Title	1 Aug 84
*List of Effective Pages	1 Aug 84
6-1	2 Oct 78
6-2 Blank	15 Sep 76
6-3 thru 6-7	2 Oct 78
*6-8	1 Aug 84
6-9 thru 6-13	2 Oct 78
*6-14 thru 6-15	1 Aug 84
6-16 Blank	2 Oct 78
6-17 thru 6-18	2 Oct 78
*6-19 thru 6-22	1 Aug 84
6-23	2 Oct 78
*6-24 thru 6-27	1 Aug 84
6-28 Blank	2 Oct 78

section VI
diagrams

6.1 CONFIGURATION STATUS CONTROL

Collins General Aviation Division of Rockwell International uses the following method for identifying the configuration status of a unit or subassembly.

A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — if no changes have been processed. The first change will be identified as A, the second as B, and continuing through Z to AA, AB, and ultimately to ZZ. Incorporation of design changes in a unit or subassembly that has been returned to Rockwell-Collins for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, unit one is marked REV B — RWK F and unit two is marked REV F. This indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

A reworked unit may not contain all design changes made to the reworked identifier, but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may physically appear different from a newly manufactured unit with the same alphabetic identifier.

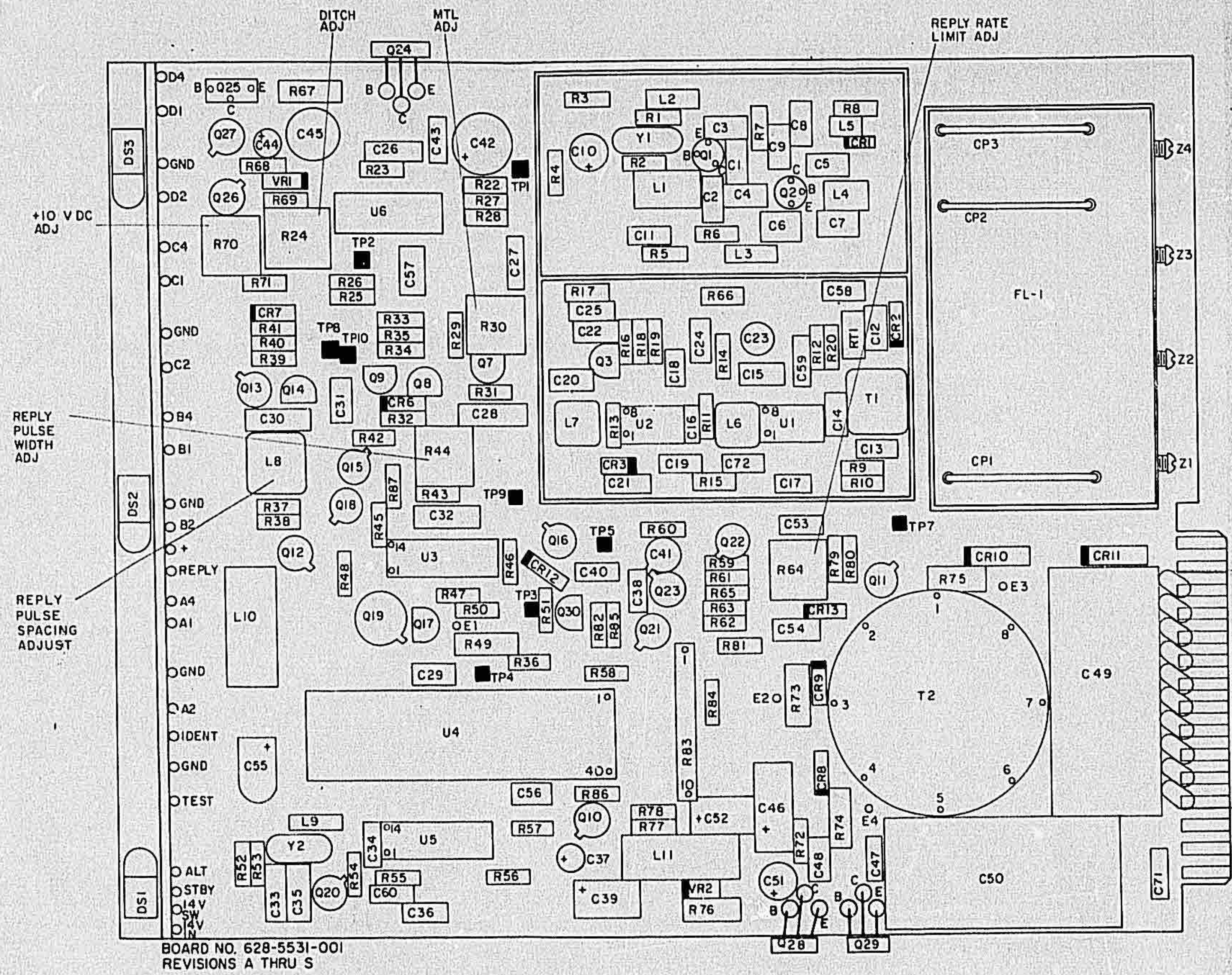
Only alphabetic identifiers that result in schematic changes are covered in this section. If a unit or subassembly has an identifier that alphabetically falls between identifiers on the schematic changes pages, or after the last identifier on the schematic changes page up to and including the latest effectivity listed below, the electrical configuration is represented by the earlier identifier listed on the schematic changes page.

6.2 SCHEMATIC DIAGRAMS

The TDR-950/950L Transponder component location diagrams, waveforms, and schematic are provided in figures 6-1 through 6-11.

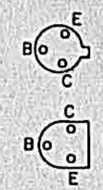
Schematic changes sheets precede the schematic and provide a description of and reason for the change, the service bulletin number (if applicable) that modifies the unit, and the production cut-in effectivity for the change.

All waveforms are typical and voltages are nominal. Conditions for waveform observation are listed adjacent to each photograph; voltages were taken using the test input conditions listed on the schematic.

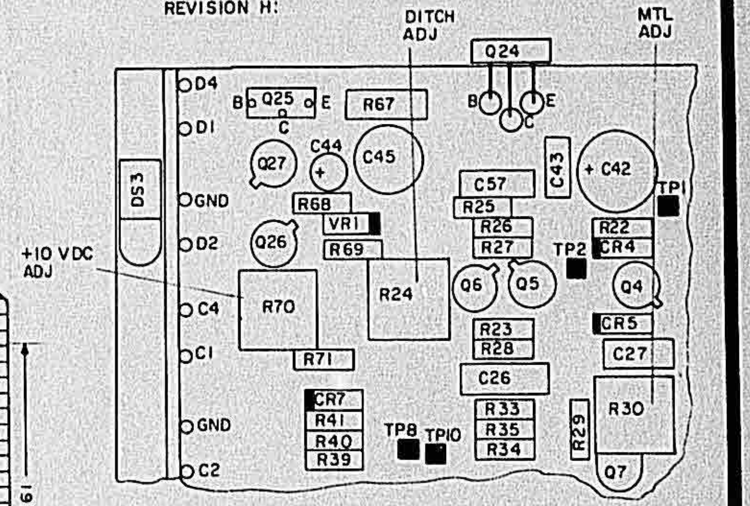


NOTE

1. TRANSISTOR LEAD DESIGNATIONS AS VIEWED FROM TOP OF BOARD ARE AS FOLLOWS:



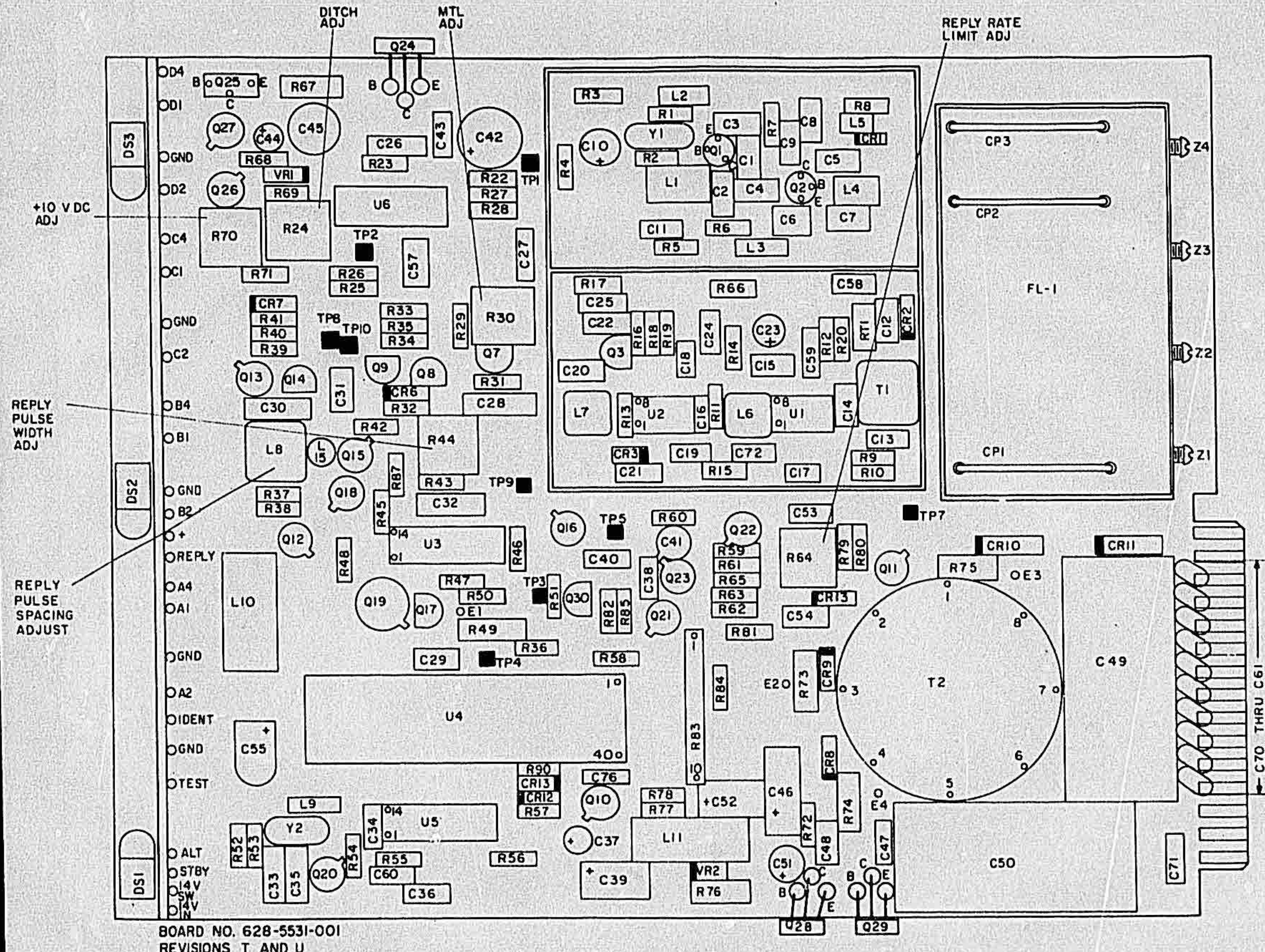
2. PROCESSOR PORTION OF BOARD LAYOUT PRIOR TO REVISION H:



628-6032

SEE BLOW-UP FICHE NO. CLT102 - ITEM B

TDR-950/950L Transponder, Component Location Diagram, REV's A Through S, Board No 628-5531-001
Figure 6-1



NOTE
1. TRANSISTOR LEAD DESIGNATIONS AS VIEWED FROM TOP OF BOARD ARE AS FOLLOWS:

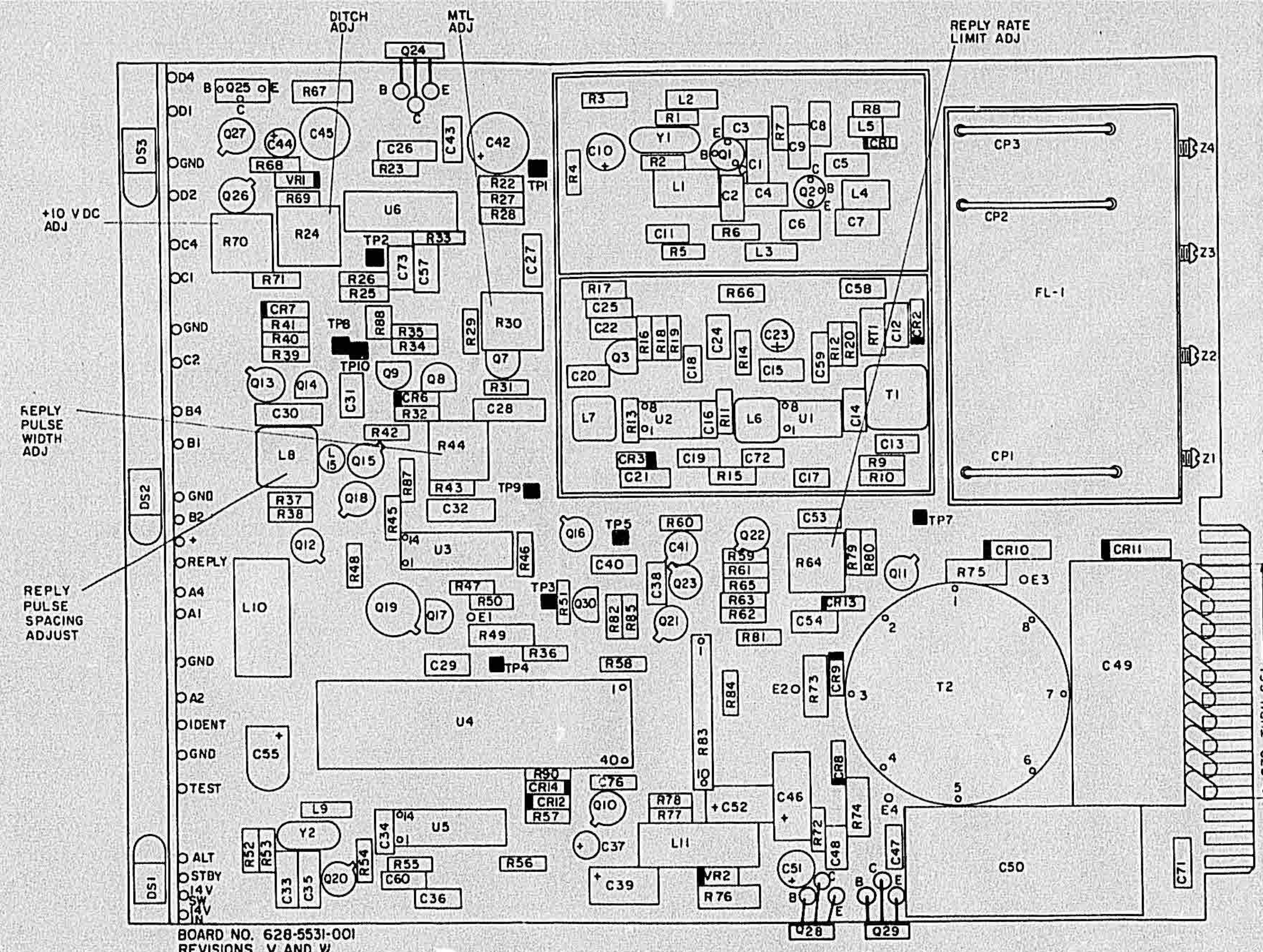
Q4-Q6, Q10-Q13, Q15, Q16, Q18-Q23, Q26, Q27.

Q3, Q7-Q9, Q14, Q17, Q3.

628-8060

TDR-950/950L Transponder, Component Location Diagram, REV's T and U, Board No 628-5531-001
Figure 6-2

SEE BLOW-UP FICHE NO. CLT102 - ITEM E



NOTE
1. TRANSISTOR LEAD DESIGNATIONS AS VIEWED FROM TOP OF BOARD ARE AS FOLLOWS:

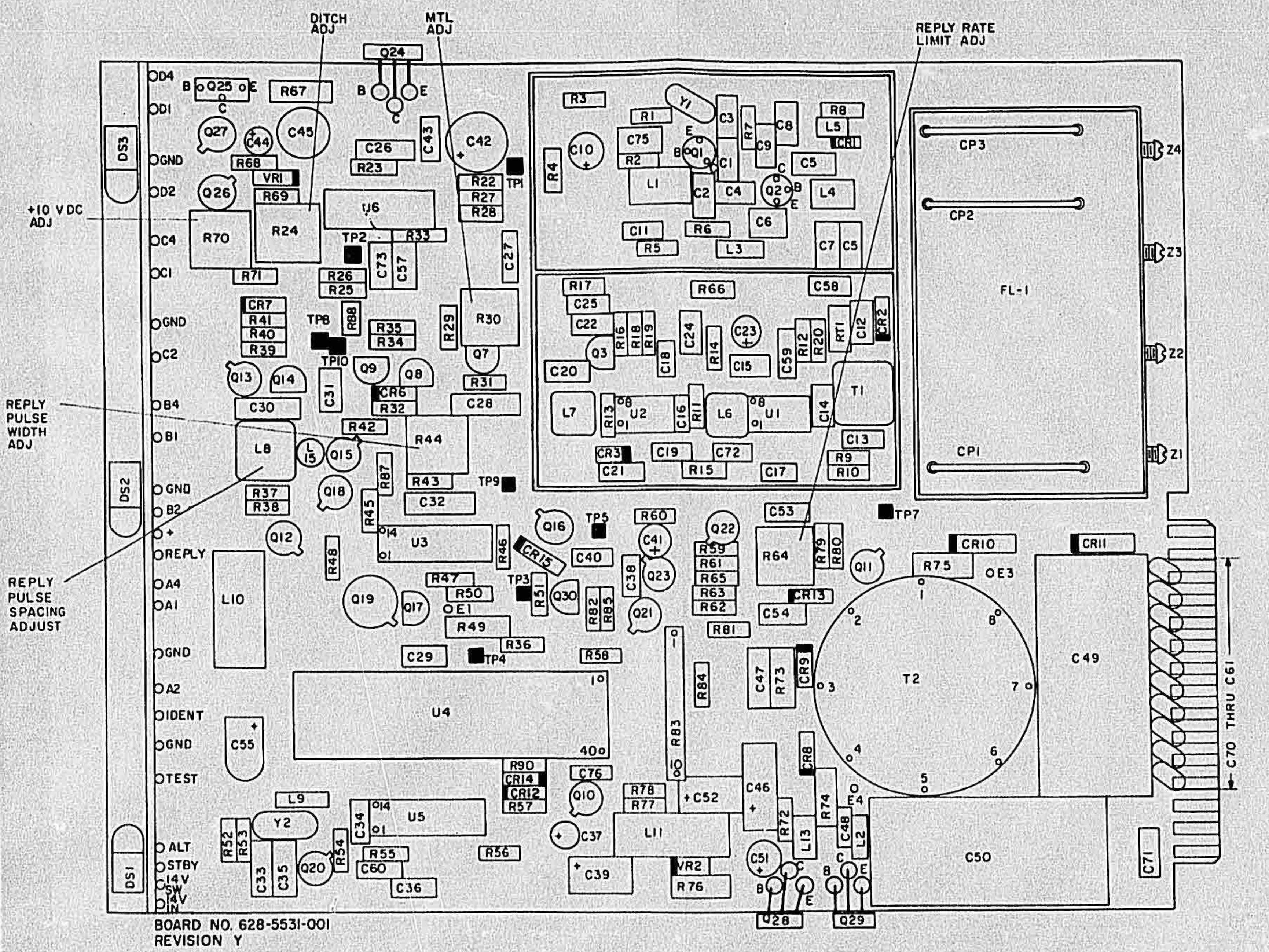
Q4-Q6, Q10-Q13, Q15, Q16, Q18-Q23, Q26, Q27.

Q3, Q7-Q9, Q14, Q17, Q3.

SEE BLOW-UP FICHE NO. CLT102 - ITEM F

628-8061

TDR-950/950L, Component Location Diagram, REV's V and W, Board No 628-5531-001
Figure 6-3



NOTE
1. TRANSISTOR LEAD DESIGNATIONS AS VIEWED FROM TOP OF BOARD ARE AS FOLLOWS:

Q4-Q6, Q10-Q13, Q15, Q16, Q18-Q23, Q26, Q27.

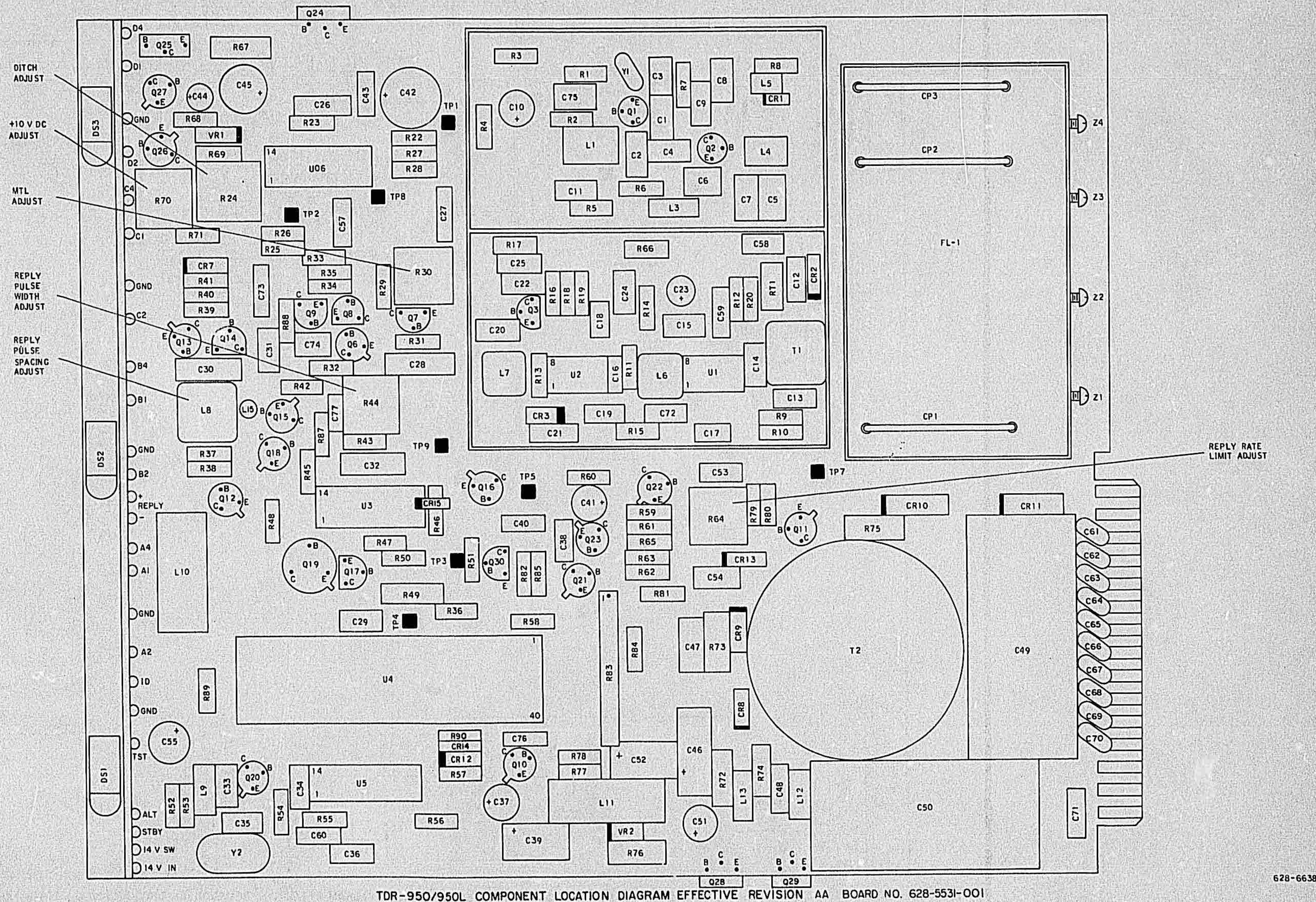
Q3, Q7-Q9, Q14, Q17, Q3.

628-8062

TDR-950/950L Transponder, Component Location Diagram, REV Y, Board No 628-5531-001
Figure 6-4

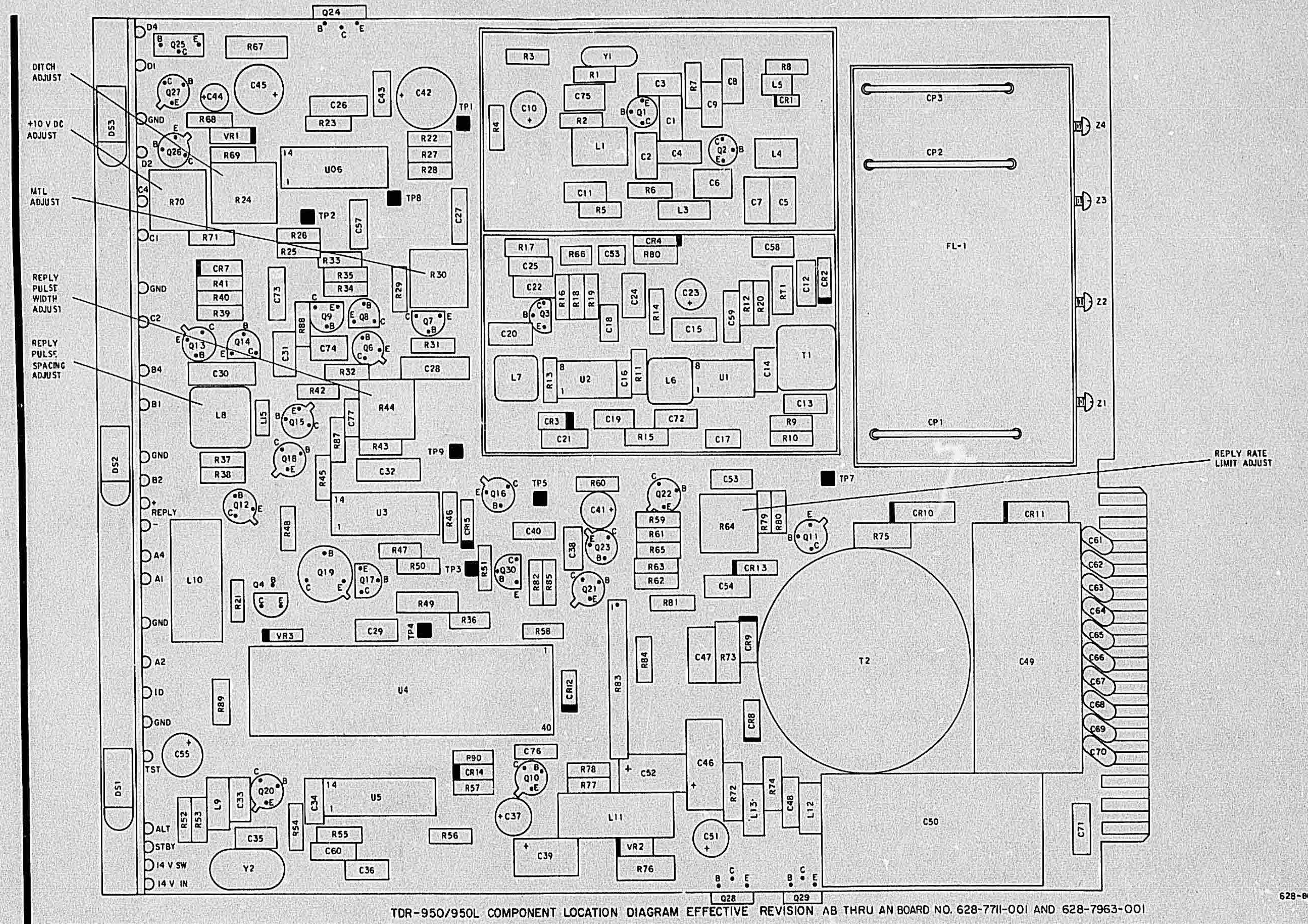
SEE BLOW-UP FICHE NO. CLT102 - ITEM 1

Revised 2 October 1978



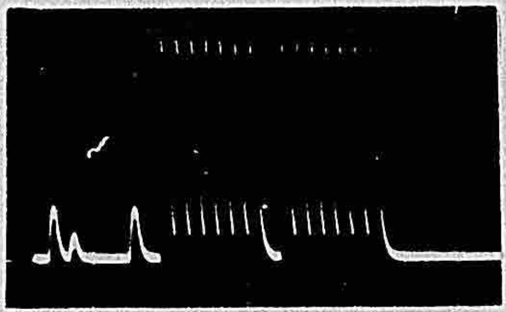
TDR-950/950L Transponder, Component Location Diagram, REV AA, Board No 628-5531-001
Figure 6-5

SEE BLOW-UP FICHE NO. CLT102 - ITEM J

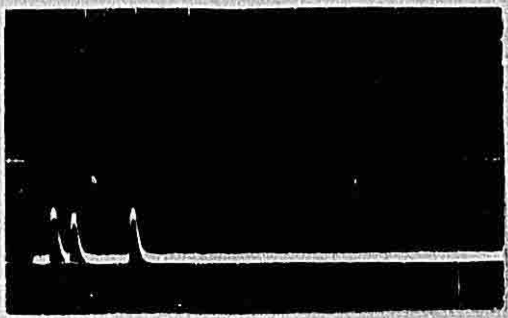


TDR-950/950L Transponder, Component Location Diagram, REV's AB through AN, Board No 628-7711-001 and 628-7963-001
Figure 6-6

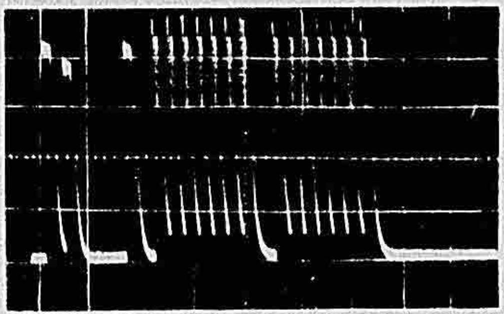
SEE BLOW-UP FICHE NO. CLT102 - ITEM C



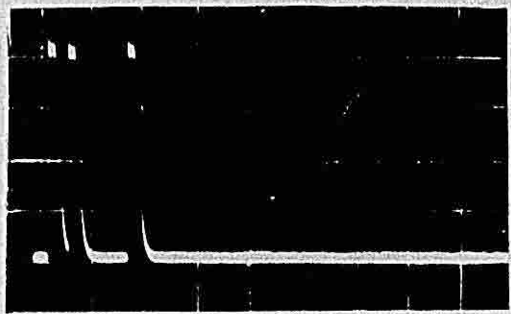
U6 PIN 7 (Q4 EMITTER REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
72 dB mW SLS PULSE 7 dB DOWN



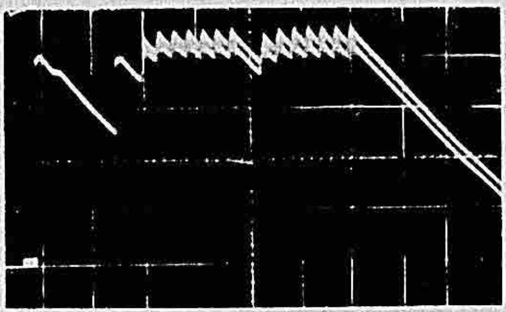
U6 PIN 7 (Q4 EMITTER REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
72 dB mW SLS PULSE 1 dB DOWN



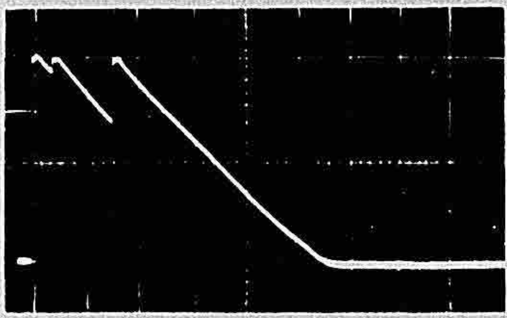
U6 PIN 7 (Q4 EMITTER REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
22 dB mW SLS PULSE 7 dB DOWN



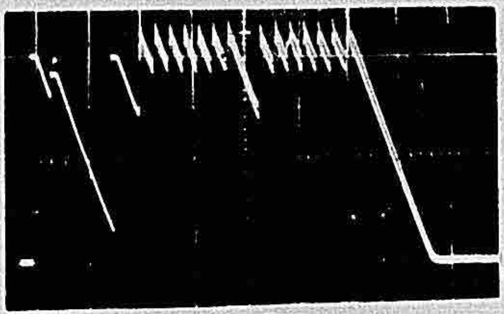
U6 PIN 7 (Q4 EMITTER REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
22 dB mW SLS PULSE 1 dB DOWN



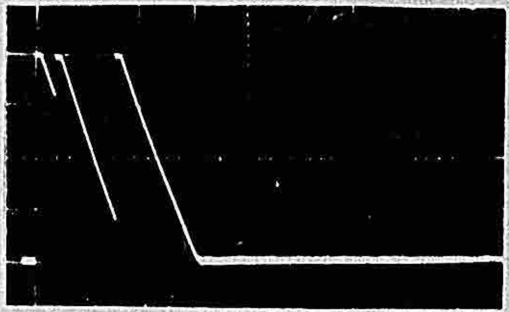
U6 PIN 2 (Q5 BASE REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
22 dB mW SLS PULSE 7 dB DOWN



U6 PIN 2 (Q5 BASE REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
22 dB mW SLS PULSE 7 dB DOWN



U6 PIN 2 (Q5 BASE REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
22 dB mW SLS PULSE 1 dB DOWN

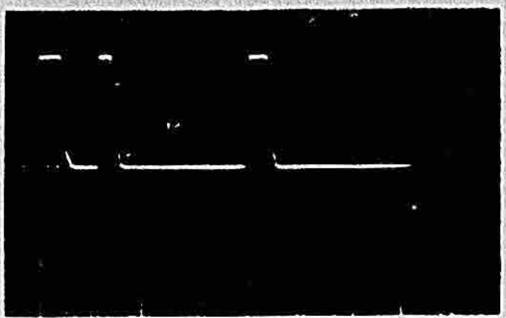


U6 PIN 2 (Q5 BASE REV A THRU G)
VERT 1 V/cm HORIZ 5 us/cm INPUT –
22 dB mW SLS PULSE 1 dB DOWN

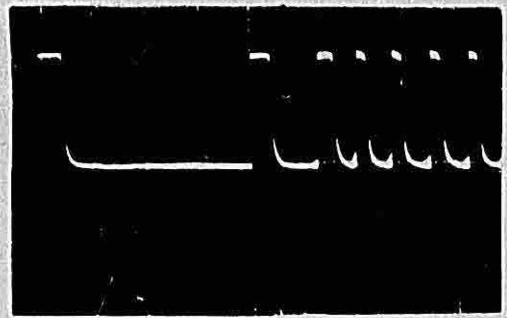
628-6136-001

MODE A INTERROGATION; CODE SELECTOR SWITCHES SET TO 7777.

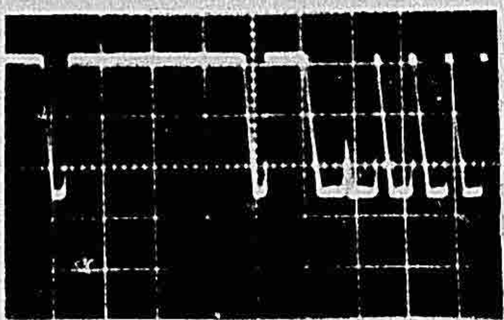
Video Processor Waveforms
Figure 6-7



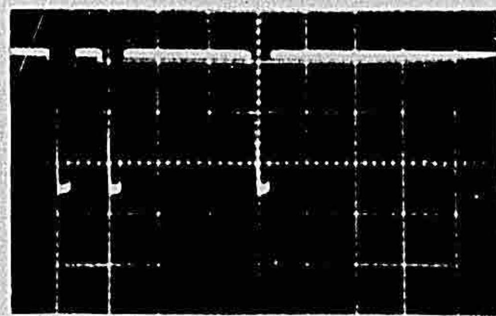
Q9 COLLECTOR VERT 5 V/CM
HORIZ 2 us/CM INPUT −72 dB mW
SLS PULSE 1 dB DOWN



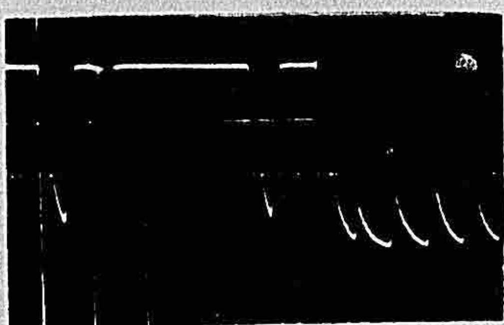
Q9 COLLECTOR VERT 5 V/CM
HORIZ 2 us/CM INPUT −42 dB mW
SLS PULSE 7 dB DOWN



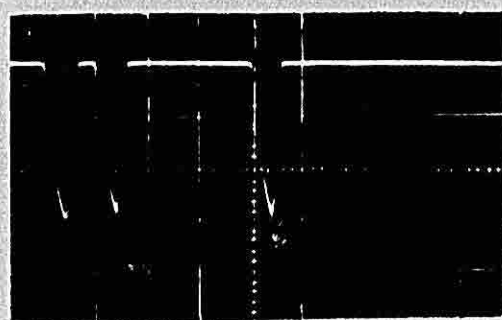
Q7 COLLECTOR (AFTER REV R) VERT 2 V/cm
HORIZ 2 us/cm, INPUT −72 dB mW
SLS PULSE 7 dB DOWN, GND 3 cm DOWN.



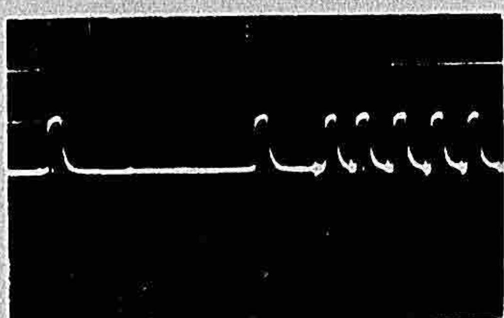
Q7 COLLECTOR (AFTER REV R) VERT 2 V/cm
HORIZ 2 us/cm, INPUT −72 dB mW
SLS PULSE 1 dB DOWN, GND 3 cm DOWN.



Q7 COLLECTOR (BEFORE REV R) VERT 5 V/cm
HORIZ 2 us/cm INPUT −72 dB mW
SLS PULSE 7 dB DOWN

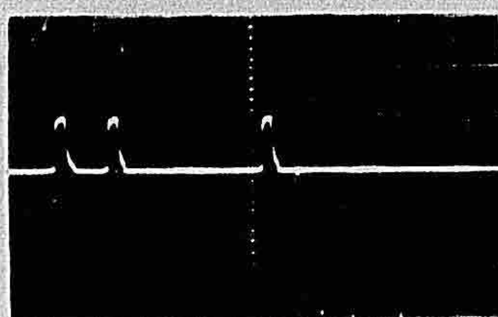


Q7 COLLECOTR (BEFORE REV R) VERT 5 V/cm
HORIZ 3 us/cm INPUT −72 dB mW
SLS PULSE 1 dB DOWN



Q8 COLLECTOR VERT 5 V/CM
HORIZ 2 us/CM INPUT −42 dB mW
SLS PULSE 7 dB DOWN

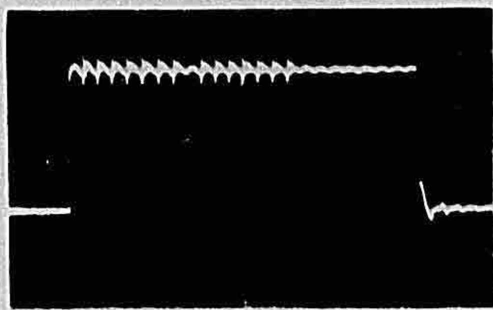
MODE A INTEROGATION:
CODE SELECTOR SWITCHES
SET TO 7777.



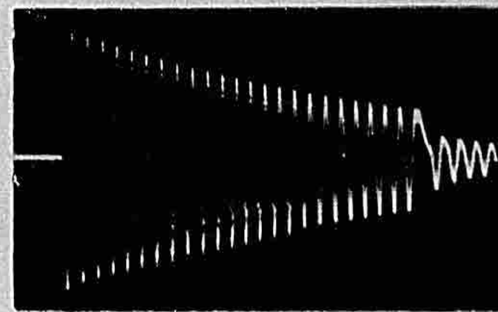
Q8 COLLECTOR VERT 5 V/CM
HORIZ 2 us/CM INPUT −72 dB mW
SLS PULSE 1 dB DOWN

628-6136-001

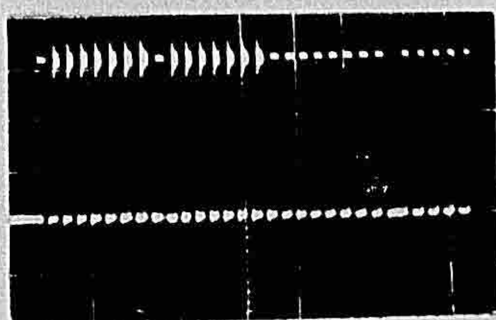
Video Processor Waveforms
Figure 6-8



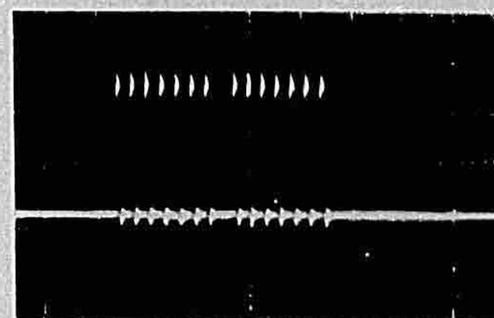
Q12 BASE VERT 2 V/CM
HORIZ 5 us/CM GND 1 CM DOWN
INPUT –42 dB mW SLS PULSE 7 dB DOWN



Q13 BASE VERT 2 V/CM
HORIZ 5 us/CM INPUT –42 dB mW
SLS PULSE 7 dB DOWN

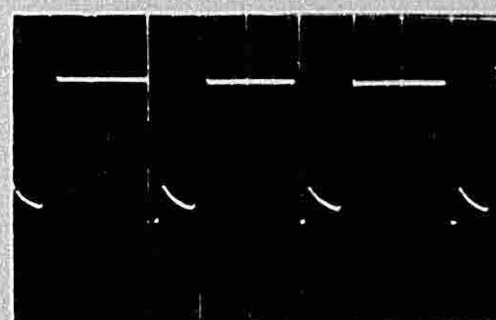


U4 PIN 9 VERT 2 V/CM
HORIZ 5 us/CM GND 1 CM DOWN
INPUT –42 dB mW SLS PULSE 7 dB DOWN

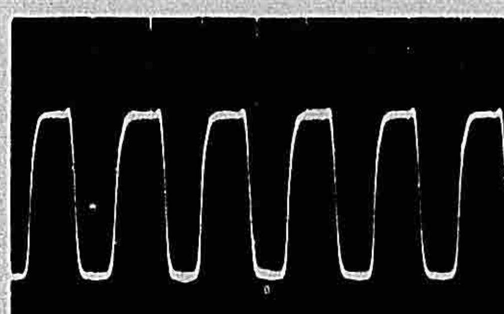


U3 PIN 6 VERT 2 V/CM
HORIZ 5 us/CM GND 1 CM DOWN
INPUT –42 dB mW SLS PULSE 7 dB DOWN

Q19 COLLECTOR VERT 20 V/CM
HORIZ 5 us/CM GND 1 CM DOWN
INPUT –42 dB mW SLS PULSE 7 dB DOWN



Q19 COLLECTOR VERT 20 V/CM
HORIZ 0.5 us/CM GND 1 CM DOWN
INPUT –42 dB mW SLS PULSE 7 dB DOWN

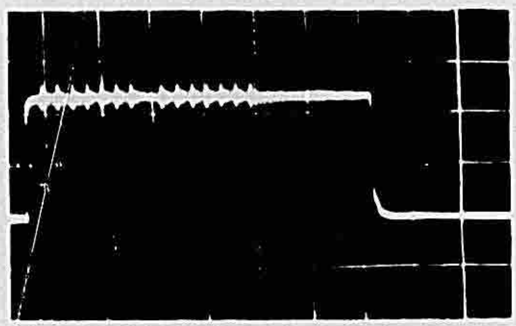


U4 PIN 32 VERT 5 V/CM
HORIZ 0.2 us/CM INPUT –47 dB mW
SLS PULSE 7 dB DOWN

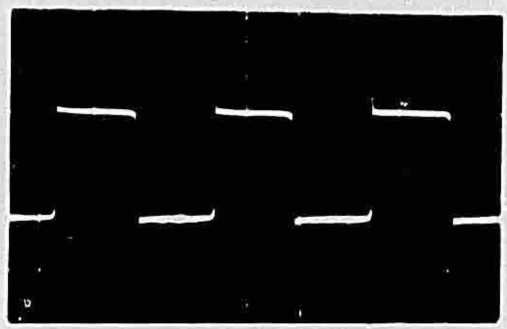
628-6136-001
TP4-4679-037

MODE A INTERROGATION; CODE SELECTOR SWITCHES SET TO 7777.

Decoder-Encoder Clock Generators and Modulator Waveforms
Figure 6-9



U4 PIN 4 VERT 5 V/CM
HORIZ 5 us/CM GND 1 CM DOWN
INPUT -42 dB mW SLS PULSE 7 dB DOWN



Q28 EMITTER VERT 10 V/CM
HORIZ 20 us/CM

MODE A INTERROGATION; CODE SELECTOR SWITCHES SET TO 7777.

628-6136-001

Reply Rate Limiter and Power Supply Waveforms
Figure 6-10

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
1	Capacitor C24 was 2 pF; CR1 was 1N4454. C24 made test select to improve feedback shaping. CR1 type changed to improve harmonic generator operation.	NA	REV D
2	Reference designator C33 was included twice. Changed 10-μF capacitor in IF/detector section to C23.	NA	NA
3	Added inductors L12 and L13 and changed value of C47 and C48 from 2200 pF to 0.1 μF to reduce ADF interference.	NA	REV E
4	Added L14 to improve LO temperature performance.	NA	REV G
5	Complete redesign of video processor to improve performance. Refer to schematic apron for processor circuit prior to REV H.	NA	REV H
6	Added three ferrite beads each on V1 plate, cathode, and filament wires to reduce L-band interference to ADF.	SB No 2	Serial no 1778
7	Added C73 and R88 and changed value of R25 from 22 to 18 kΩ and R33 from 3.3 to 10 kΩ to eliminate dc coupling to Q9.	NA	REV M
	Changed value of R2 from 10 to 12 kΩ and R73 and R74 from 39 to 47 ohms to improve inverter startup.	NA	REV N

TDR-950/950L Transponder, Schematic Diagram
Figure 6-11 (Sheet A)

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
8	Changed value of C37 from 1.5 to 22 μF, and R29 from 15 to 12 kΩ to prevent power-on ident illumination in 28-V installations.	NA	REV R
9	Changed C3 from 15 to 22 pF, R1 from 2.2 to 1.5 kΩ, and R2 from 12 to 4.7 kΩ to improve crystal control of local oscillator.	NA	REV S
10	Added C76, CR13, R90; deleted R86. Changes made to reduce test current.	NA	REV T
11	Changed value of L8 from 136 to 43 μH and added L15 to reduce reply clock timing variation with humidity in units not containing TOKO coils.	SB 5	REV U
12	Changed R23 from 150 to 120 kΩ, deleted CR13, added CR14, and made R66 a test select to improve pulse width discriminator operation.	NA	REV V
14	Deleted L2 and the 8200 Ω value for R66; changed value of R1 from 1.5 to 2.2 kΩ, R2 from 4.7 to 3.9 kΩ, and C3 from 22 to 15 pF; added C75 and CR15. Revision prevents on-off-on lockup in 28-V installations and improves local oscillator operation. Refer to partial schematic on apron of unit schematic for configuration of local oscillator prior to revision.	SB 7	REV Y (pc board REV K)
15	Deleted CR6; changed C27 from 4700 to 0.01 μF, and R31 from 1.8 to 1.2 kΩ; added C74, C77, Q6, and R89. Revision provides improved rejection of DME interference. Refer to partial schematic on apron of unit schematic for configuration of pulse width discriminator prior to revision.	NA	REV AA

TDR-950/950L Transponder, Schematic Diagram
Figure 6-11 (Sheet B)

SCHEMATIC CHANGES

REVISION IDENTIFICATION	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
U	Added R21, VR3, and Q4; changed C3 from 15 to 22 pF. Revision ensures stable V_{cc} supply for U3.	NA	REV AB
V	Changed value of C73 from 1000 pF to 0.1 μF and R16 from 100 to 150 Ω to improve sls at 3 dB above MTL.	NA	REV AE
W	Added Q10, R77, and R78 to include incoming suppression.	SB 1/SB 9	REV AG
Y	Changed Q19 from 2N2405 to a selected 2N5682 to improve modulator reliability.	NA	REV AK
AA	Added CR4, R80, and C53. Changed R12 from 33 to 18 k and changed R66 to 10k variable to eliminate test selection of if amplifiers.	NA	REV AN

TDR-950/950L Transponder, Schematic Diagram
Figure 6-11 (Sheet C)

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
C1	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF ±0.5PF, 500VDC	913-3313-010
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 20PF ±10%, 500VDC	913-3313-090
C3	CAPACITOR, FXD, CER DIEL, 22PF, 10%, 500V (EFF REV AB)	913-3313-060
C3	CAPACITOR, FXD, CER DIEL, 15PF, 10%, 500V (EFF REV Y)	913-3313-040
C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22PF ±10%, 500VDC (EFF REV S)	913-3313-060
C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 15PF ±10%, 500VDC	913-3313-040
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 7PF ±10%, 500VDC	913-3313-020
C5	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF ±0.5PF, 500VDC	913-3313-010
C6	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 20PF ±10%, 500VDC	913-3313-090
C7	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 220PF +80-20%, 250VDC	913-3298-090
C8	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 15PF ±10%, 500VDC	913-3313-040
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 7PF ±10%, 500VDC	913-3313-020
C10	CAPACITOR, FIXED, TANTALUM, 10UF ±20%, 20VDC	184-9113-070
C11	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 220PF +80-20%, 250VDC	913-3298-090
C12	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF, ±0.5PF, 500VDC	913-3313-010
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF ±0.5PF, 500VDC	913-3313-010
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 18PF ±10%, 500VDC	913-3313-050
C16	CAPACITOR, FIXED CERAMIC DIELECTRIC, 220PF +80-20%, 250VDC	913-3298-090
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 22PF ±10%, 500VDC	913-3313-060
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 100PF ±10%, 100VDC	913-3298-170

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
C23	CAPACITOR, FIXED, TANTALUM, 10UF ±20%, 20VDC	184-9113-070
C24	TEST SELECT (EFF REV D)	
	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 2PF ±0.5PF, 500V	913-3313-070
	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 3PF ±0.5PF, 500V	913-3313-080
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF ±0.5PF, 500V	913-3313-010
C24	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 2PF ±0.5PF, 500VDC	913-3313-070
C25	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC (EFF REV H)	913-3310-010
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC	913-3310-020
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50V (EFF REV AA)	913-3298-130
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4700PF +80-20%, 250VDC	913-3298-060
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC (EFF REV H)	913-3310-010
C28	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC	913-3310-020
C29	TEST SELECT, FIXED, CERAMIC DIELECTRIC, 10PF ±10%, 500VDC	913-3313-030
C29	TEST SELECT, FIXED, CERAMIC DIELECTRIC, 22PF ±10%, 500VDC	913-3313-060
C29	TEST SELECT, FIXED, CERAMIC DIELECTRIC, 36PF ±10%, 500VDC	913-3313-100
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC	913-3310-010
C31	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 36PF ±10%, 500VDC	913-3313-100
C32	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC (EFF REV H)	913-3310-010
C32	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 390PF ±5%, 50VDC	913-3310-020
C33	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 100PF ±10%, 100VDC	913-3298-170
C34	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C35	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 36PF ±10%, 500VDC	913-3313-100
C36	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C37	CAPACITOR, FIXED, TANTALUM, 22UF ±20%, 15V (EFF REV R)	184-9113-080
C37	CAPACITOR, FIXED, TANTALUM, 1.5UF ±20%, 25VDC	184-9113-040

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
C38	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.1UF +80-20%, 12VDC	913-3298-020
C39	CAPACITOR, FIXED, TANTALUM, 47UF ±20%, 15VDC	184-9113-100
C40	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C41	CAPACITOR, FIXED, TANTALUM, 10UF ±20%, 20VDC	184-9113-070
C42	CAPACITOR, FIXED, ELECTROLYTIC, 47UF +100-20%, 35VDC	183-1471-190
C43	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C44	CAPACITOR, FIXED, TANTALUM, 1.5UF ±20%, 25VDC	184-9113-040
C45	CAPACITOR, FIXED, TANTALUM, 47UF ±20%, 15VDC	184-9113-100
C46	CAPACITOR, FIXED, TANTALUM, 100UF ±20%, 15VDC	184-9113-150
C47	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.1UF, +80-20%, 12VDC (EFF REV E)	913-3298-020
C47	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C48	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.1UF, +80-20%, 12VDC (EFF REV E)	913-3298-020
C48	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C49	CAPACITOR, FIXED, PAPER DIELECTRIC, 0.1UF ±10%, 1000VDC	951-0878-010
C50	CAPACITOR, FIXED, PAPER DIELECTRIC, 0.1UF ±10%, 1000VDC	951-0878-010
C51	CAPACITOR, FIXED, TANTALUM, 10UF ±20%, 20VDC	184-9113-070
C52	CAPACITOR, FIXED, TANTALUM, 47UF ±20%, 15VDC	184-9113-100
C53	CAPACITOR, CER, 0.1UF, +80-20%, 12VDC (EFF REV AN)	913-3298-020
C53	NOT USED	
C54	NOT USED	
C55	CAPACITOR, FIXED, TANTALUM, 22UF ±20%, 15VDC	184-9113-080
C56	NOT USED	
C57	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 100PF ±10%, 100VDC	913-3298-170
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 18PF ±10%, 500VDC	913-3313-050
C59	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500VDC	913-3298-110
C60	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C63	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C64	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C65	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
C66	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C67	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C68	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C69	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C70	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50VDC	913-3298-130
C71	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 2200PF +80-20%, 100VDC	913-3298-160
C72	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 4PF ±0.5PF, 500VDC	913-3313-010
C73	CAPACITOR, FXD, CER DIEL, 0.1UF, +80-20%, 12V (EFF REV AE)	913-3298-020
C73	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 1000PF +80-20%, 500V (EFF REV M)	913-3298-110
C74	CAPACITOR, FIXED, MICA DIELECTRIC, 270PF ±5%, 300V (EFF REV R)	912-2099-400
C75	CAPACITOR, FIXED, CERAMIC DIELECTRIC, 0.01UF +80-20%, 50V (EFF REV R)	913-3298-130
C76	CAPACITOR, FIXED, CER DIEL, 0.01UF, +80-20%, 50V (EFF REV T)	913-3298-130
C77	CAPACITOR, FXD, CER DIEL, 0.01UF, +80-20%, 50V (EFF REV AA)	913-3298-130
CP1	COUPLING LOOP	628-5738-001
CP2	COUPLING LOOP	628-5738-001
CP3	COUPLING LOOP	628-5738-001
CR1	DIODE, SILICON SIGNAL DA 1702 (EFF REV D)	353-0295-010
CR1	DIODE, SILICON SWITCHING, DA1702	353-0295-010
CR2	DIODE, SILICON HOT CARRIER, 5082-2835	353-0448-010
CR3	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR4	DIODE, 1N4454 (EFF REV AN)	353-3741-010
CR4	NOT USED (EFF REV H TO REV AN)	
CR4	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR5	NOT USED (EFF REV H)	
CR5	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR6	NOT USED (EFF REV AA)	
CR6	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR7	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR8	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR9	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR10	DIODE, SILICON HIGH VOLTAGE, SEM30	353-0447-010
CR11	DIODE, SILICON HIGH VOLTAGE, SEM30	353-0447-010
CR12	DIODE, SILICON SWITCHING, 1N4454	353-3741-010
CR13	NOT USED (EFF REV V)	
CR13	DIODE, SILICON SWITCHING, 1N4454 (EFF REV T)	353-3741-010
CR14	DIODE, 1N4454 (EFF REV V)	353-3741-010
CR15	DIODE, 1N4454 (EFF REV Y; SB 7)	353-3741-010

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
DS1	LAMP, INCANDESCENT, T1-3/4, 14V	262-1424-040
DS2	LAMP, INCANDESCENT, T1-3/4, 14V	262-1424-040
DS3	LAMP, INCANDESCENT, T1-3/4, 14V	262-1424-040
DS4	LAMP, INCANDESCENT, T1-3/4, 14V	262-1424-010
FL1	PRESELECTOR ASSEMBLY	628-5631-001
L1	RF COIL	240-0963-010
L2	NOT USED (EFF REV Y)	
L2	RF COIL, 1.5UH ±10%	240-2742-120
L3	RF COIL, 0.15UH ±10%	240-2742-100
L4	RF COIL	240-0964-010
L5	RF CHOKE ASSEMBLY	628-5632-001
L6	INDUCTOR, VARIABLE, 0.25UH	242-0435-010
L7	INDUCTOR, VARIABLE, 0.25UH	242-0435-010
L8	INDUCTOR, VARIABLE, 43UH (EFF REV U; SB 5)	242-0434-020
L8	INDUCTOR, VARIABLE, 135UH	242-0434-010
L9	RF COIL, 470UH	240-2742-240
L10	HASH CHOKE, 100UH	240-0956-010
L11	HASH CHOKE, 100UH	240-0956-010
L12	RF COIL, 2.2UF ±10% (EFF REV E)	240-2741-150
L13	RF COIL, 2.2UF ±10% (EFF REV E)	240-2741-150
L14	COIL (PART OF BOARD; EFF REV H)	
L14	RF COIL, 2 TURNS NO 20 AWG (EFF REV G)	628-6252-001
L15	COIL, 100UH (EFF REV AD)	240-2747-320
L15	COIL, 100UH (EFF REV AC)	240-2741-060
L15	COIL, 100UH (EFF REV U; SB 5)	240-2747-320
Q1	TRANSISTOR, SILICON NPN, MPS3563	352-5020-010
Q2	TRANSISTOR, NPN HIGH SPEED LOGIC SWITCH, MPS3646	352-5033-010
Q3	TRANSISTOR, PNP SILICON ANNULAR LOW LEVEL SWITCHING, MPS3640	352-5034-010
Q4	TRANSISTOR, SILICON NPN, 2N2222 (EFF REV AB)	352-5021-010
Q4	NOT USED (EFF REV H)	
Q4	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q5	NOT USED (EFF REV H)	
Q5	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q6	TRANSISTOR, SILICON NPN, 2N2222 (EFF REV R)	352-5021-010
Q6	NOT USED (EFF REV H)	
Q6	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q7	TRANSISTOR, PNP SILICON ANNULAR LOW LEVEL SWITCHING MPS3640	352-5034-010
Q8	TRANSISTOR, NPN SILICON SWITCHING, MPS2369	352-5015-010
Q9	TRANSISTOR, MPS3640 (EFF REV M)	352-5034-010
Q9	TRANSISTOR, MPS3640 (EFF REV L)	352-5034-020
Q9	TRANSISTOR, PNP SILICON ANNULAR LOW LEVEL SWITCHING MPS3640	352-5034-010
Q10	TRANSISTOR, 2N2222 (EFF REV AG; SB 1/SB 9)	352-5021-010
Q11	NOT USED	
Q12	TRANSISTOR, HIGH SPEED EPITAXIAL PNP SILICON, 2N2907A	352-5019-010
Q13	TRANSISTOR, HIGH SPEED EPITAXIAL PNP SILICON, 2N2907A	352-5019-010

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
Q14	TRANSISTOR, NPN SILICON SWITCHING, MPS2369	352-5015-010
Q15	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q16	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q17	TRANSISTOR, NPN SILICON SWITCHING, MPS2369	352-5015-010
Q18	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q19	TRANSISTOR, SELECTED 2N5682 (EFF REV AK)	352-1528-010
Q19	TRANSISTOR, NPN SILICON ANNULAR, 2N2405	352-5036-010
Q20	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q21	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q22	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q23	TRANSISTOR, SILICON NPN, 2N2222	352-5021-010
Q24	TRANSISTOR, SILICON PNP, EPITAXIAL BASE, 40874	352-5037-010
Q25	TRANSISTOR, COMPLEMENTARY SILICON, MJE200	352-5026-010
Q26	TRANSISTOR, HIGH SPEED EPITAXIAL PNP SILICON, 2N2907A	352-5019-010
Q27	TRANSISTOR, HIGH SPEED EPITAXIAL PNP SILICON, 2N2907A	352-5019-010
Q28	TRANSISTOR, COMPLEMENTARY SILICON, MJE200	352-5026-010
Q29	TRANSISTOR, COMPLEMENTARY SILICON, MJE200	352-5026-010
Q30	TRANSISTOR, NPN SILICON DARLINGTON AMPLIFIER, MPS-A14	352-5035-010
R1	RESISTOR, FXD, CMPSN, 2200 OHMS, 10%, 1/4W (EFF REV Y)	745-7950-290
R1	RESISTOR, FIXED, COMPOSITION, 1500 OHMS ±10%, 1/4W (EFF REV S)	745-7950-270
R1	RESISTOR, FIXED, COMPOSITION, 2200 OHMS ±10%, 1/4W	745-7950-290
R2	RESISTOR, FXD, CMPSN, 3900 OHMS, 10%, 1/4 (EFF REV Y)	745-7950-290
R2	RESISTOR, FIXED, COMPOSITION, 4.7K ±10%, 1/4W (EFF REV S)	745-7950-330
R2	RESISTOR, FIXED, COMPOSITION, 12K ±10%, 1/4W (EFF REV N)	745-7950-380
R2	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R3	RESISTOR, FIXED, COMPOSITION, 330 OHMS ±10%, 1/4W	745-7950-190
R4	RESISTOR, FIXED, COMPOSITION, 22 OHMS ±10%, 1/4W	745-7950-050
R5	RESISTOR, FIXED, COMPOSITION, 100 OHMS ±10%, 1/4W	745-7950-130
R6	RESISTOR, FIXED, COMPOSITION, 2200 OHMS ±10%, 1/4W	745-7950-290
R7	RESISTOR, FIXED, COMPOSITION, 6800 OHMS ±10%, 1/4W	745-7950-350
R8	RESISTOR, FIXED, COMPOSITION, 150 OHMS ±10%, 1/4W	745-7950-370
R9	RESISTOR, FIXED, COMPOSITION, 100 OHMS ±10%, 1/4W	745-7950-130
R10	RESISTOR, FIXED, COMPOSITION, 22,000 OHMS ±10%, 1/4W	745-7950-410
R11	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R12	RESISTOR, CMPSN, 18K, 10%, 1/4W (EFF REV AN)	745-7950-400
R12	RESISTOR, FIXED, COMPOSITION, 33K ±5%, 1/4W (EFF REV P)	745-7958-350
R12	RESISTOR, FIXED, COMPOSITION, 33,000 OHMS ±10%, 1/4W	745-7950-430
R13	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R14	RESISTOR, FIXED, COMPOSITION, 33K ±5%, 1/4W (EFF REV P)	745-7958-350
R14	RESISTOR, FIXED, COMPOSITION, 33,000 OHMS ±10%, 1/4W	745-7950-430
R15	RESISTOR, FIXED, COMPOSITION, 22 OHMS ±10%, 1/4W	745-7950-050

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
R16	RESISTOR, FXD, CMPSN, 150 OHMS, 10%, 1/4W (EFF REV AE)	745-7950-150
R16	RESISTOR, FIXED, COMPOSITION, 100 OHMS ±10%, 1/4W	745-7950-130
R17	RESISTOR, FIXED, COMPOSITION, 22 OHMS ±10%, 1/4W	745-7950-050
R18	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R19	RESISTOR, FIXED, COMPOSITION, 3900 OHMS ±10%, 1/4W	745-7950-320
R20	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R21	RESISTOR, FXD, CMPSN, 1K, 10%, 1/4W (EFF REV AB)	745-7950-250
R21	NOT USED	
R22	RESISTOR, FIXED, COMPOSITION, 4700 OHMS ±10%, 1/4W	745-7950-330
R23	RESISTOR, FXD, CMPSN, 120K, 10%, 1/4W (EFF REV V)	745-7950-500
R23	RESISTOR, FIXED, COMPOSITION, 150 KILOHMS ±10%, 1/4W	745-7950-510
R24	RESISTOR, VARIABLE, SINGLE TURN CERMET, 100 KILOHMS ±20%, 1/2W	382-0041-130
R25	RESISTOR, FIXED, COMPOSITION, 18K ±10%, 1/4W (EFF REV M)	745-7950-400
R25	RESISTOR, FIXED, COMPOSITION, 22,000 OHMS ±10%, 1/4W	745-7950-410
R26	RESISTOR, FIXED, COMPOSITION, 220 KILOHMS ±10%, 1/4W	745-7950-530
R27	RESISTOR, FIXED, COMPOSITION, 390 OHMS ±10%, 1/4W (EFF REV H)	745-7950-200
R27	RESISTOR, FIXED, COMPOSITION, 100 OHMS ±10%, 1/4W	745-7950-130
R28	RESISTOR, FIXED, COMPOSITION, 390 OHMS ±10%, 1/4W (EFF REV H)	745-7950-200
R28	RESISTOR, FIXED, COMPOSITION, 100 OHMS ±10%, 1/4W	745-7950-130
R29	RESISTOR, FIXED, COMPOSITION, 12K ±10%, 1/4W (EFF REV R)	745-7950-380
R29	RESISTOR, FIXED, COMPOSITION, 15,000 OHMS ±10%, 1/4W	745-7950-390
R30	RESISTOR, VARIABLE, SINGLE TURN CERMET, 1000 OHMS ±20%, 1/2W (EFF REV H)	382-0041-010
R30	RESISTOR, VARIABLE, SINGLE TURN CERMET, 2000 OHMS ±20%, 1/2W	382-0041-030
R31	RESISTOR, FIXED, COMPOSITION, 1200 OHMS ±10%, 1/4W (EFF REV AA)	745-7950-260
R31	RESISTOR, FIXED, COMPOSITION, 1800 OHMS ±10%, 1/4W	745-7950-280
R32	RESISTOR, FIXED, COMPOSITION, 2200 OHMS ±10%, 1/4W	745-7950-290
R33	RESISTOR, FIXED, COMPOSITION, 10K ±10%, 1/4W (EFF REV M)	745-7950-370
R33	RESISTOR, FIXED, COMPOSITION, 3300 OHMS ±10%, 1/4W	745-7950-310
R34	RESISTOR, FIXED, COMPOSITION, 1500 OHMS ±10%, 1/4W	745-7950-270
R35	RESISTOR, FIXED, COMPOSITION, 1500 OHMS ±10%, 1/4W	745-7950-270
R36	RESISTOR, FIXED, COMPOSITION, 4700 OHMS ±10%, 1/4W	745-7950-330
R37	RESISTOR, FIXED, COMPOSITION, 470 OHMS ±10%, 1/4W	745-7950-210
R38	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R39	RESISTOR, FIXED, COMPOSITION, 190 OHMS ±10%, 1/4W	745-7950-190
R40	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R41	RESISTOR, FIXED, COMPOSITION, 2200 OHMS ±10%, 1/4W	745-7950-290
R42	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R43	RESISTOR, FIXED, COMPOSITION, 1200 OHMS ±10%, 1/4W (EFF REV H)	745-7950-260

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
R43	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R44	RESISTOR, VARIABLE, SINGLE TURN CERMET, 1000 OHMS ±20%, 1/2W	382-0041-010
R45	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R46	RESISTOR, FIXED, COMPOSITION, 3900 OHMS ±10%, 1/4W	745-7950-320
R47	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R48	RESISTOR, FIXED, COMPOSITION, 47 OHMS ±10%, 1/4W	745-7950-090
R49	RESISTOR, FIXED, COMPOSITION, 47 OHMS ±10%, 1/2W	745-7951-090
R50	RESISTOR, FIXED, COMPOSITION, 220 OHMS ±10%, 1/4W	745-7950-170
R51	RESISTOR, FIXED, COMPOSITION, 2200 OHMS ±10%, 1/4W	745-7950-290
R52	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R53	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R54	RESISTOR, FIXED, COMPOSITION, 820 OHMS ±10%, 1/4W (EFF REV H)	745-7950-240
R54	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R55	RESISTOR, FIXED, COMPOSITION, 1 MEGOHM ±10%, 1/4W	745-7950-610
R56	RESISTOR, FIXED, COMPOSITION, 330 OHMS ±10%, 1/4W	745-7950-190
R57	RESISTOR, FIXED, COMPOSITION, 680 KILOHMS ±10%, 1/4W	745-7950-590
R58	RESISTOR, FIXED, COMPOSITION, 3900 OHMS ±10%, 1/4W	745-7950-320
R59	RESISTOR, FIXED, COMPOSITION, 3900 OHMS ±10%, 1/4W	745-7950-320
R60	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R61	RESISTOR, FIXED, COMPOSITION, 560 OHMS ±10%, 1/4W	745-7950-220
R62	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R63	RESISTOR, FIXED, COMPOSITION, 4700 OHMS ±10%, 1/4W	745-7950-330
R64	RESISTOR, VARIABLE, SINGLE TURN CERMET, 50,000 OHMS ±20%, 1/2W	382-0041-110
R65	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R66	RESISTOR, VAR, 10K, 10%, 1/2W (EFF REV AN)	382-0027-100
R66	TEST SELECT RESISTOR (EFF REV V)	
	RESISTOR, FXD, CMPSN, 3.9K, 10%, 1/4W	745-7950-320
	RESISTOR, FXD, CMPSN, 4.7K, 10%, 1/4W	745-7950-330
	RESISTOR, FXD, CMPSN, 6.8K, 10%, 1/4W	745-7950-350
	RESISTOR, FXD, CMPSN, 8.2K, 10%, 1/4W (EFF REV V TO REV Y)	745-7950-360
R66	RESISTOR, FIXED, COMPOSITION, 5600 OHMS ±10%, 1/4W	745-7950-340
R67	RESISTOR, FIXED, COMPOSITION, 100 OHMS ±10%, 1/2W	745-7951-130
R68	RESISTOR, FIXED, COMPOSITION, 1000 OHMS ±10%, 1/4W	745-7950-250
R69	RESISTOR, FIXED, COMPOSITION, 1500 OHMS ±10%, 1/4W	745-7950-270
R70	RESISTOR, VARIABLE, SINGLE TURN CERMET, 1000 OHMS ±20%, 1/2W	382-0041-010
R71	RESISTOR, FIXED, COMPOSITION, 1500 OHMS ±10%, 1/4W	745-7950-270
R72	RESISTOR, FIXED, COMPOSITION, 470 OHMS ±10%, 1/2W (EFF REV P)	745-7951-210
R72	RESISTOR, FIXED, COMPOSITION, 470 OHMS ±10%, 1/4W	745-7950-210
R73	RESISTOR, FIXED, COMPOSITION, 47 OHMS ±10%, 1/2W (EFF REV N)	745-7951-090
R73	RESISTOR, FIXED, COMPOSITION, 39 OHMS ±10%, 1/2W	745-7951-080
R74	RESISTOR, FIXED, COMPOSITION, 47 OHMS ±10%, 1/2W (EFF REV N)	745-7951-090

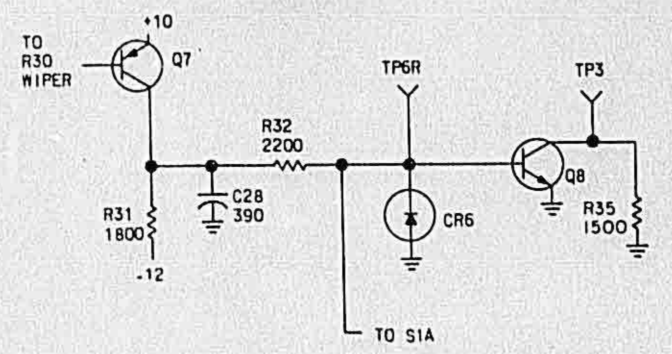
PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

SYMBOL	DESCRIPTION	PART NUMBER
R74	RESISTOR, FIXED, COMPOSITION, 39 OHMS ±10%, 1/2W	745-7951-080
R75	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/2W	745-7951-270
R76	RESISTOR, FIXED, COMPOSITION, 18 OHMS ±10%, 1/2W	745-7951-040
R77	RESISTOR, FXD, CMPSN, 22kΩ, 10%, 1/4W (EFF REV AG; SB1/SB9)	745-7950-410
R78	RESISTOR, FXD, CMPSN, 10kΩ, 10%, 1/4W (EFF REV AG; SB1/SB9)	745-7950-370
R79	NOT USED	
R80	RESISTOR, CMPSN, 1MEGOHM, 10%, 1/4W (EFF REV AN)	745-7950-610
R81	NOT USED	
R82	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W	745-7950-370
R83	RESISTOR NETWORK, SINGLE IN-LINE, 4.7 KILOHMS ±20%, 1/8W	350-4000-020
R84	RESISTOR, FIXED, COMPOSITION, 4700 OHMS ±10%, 1/4W	745-7950-330
R85	RESISTOR, FIXED, COMPOSITION, 1 MEGOHM ±10%, 1/4W	745-7950-610
R86	NOT USED (EFF REV T)	
R86	RESISTOR, FIXED, COMPOSITION, 22 OHMS ±10%, 1/4W	745-7950-050
R87	RESISTOR, FIXED, COMPOSITION, 2200 OHMS ±10%, 1/4W	745-7950-290
R88	RESISTOR, FIXED, COMPOSITION, 270K ±10%, 1/4W (EFF REV M)	745-7950-540
R89	RESISTOR, FIXED, COMPOSITION, 10,000 OHMS ±10%, 1/4W (EFF REV AA)	745-7950-370
R90	RESISTOR, FXD, CMPSN, 270K, 10%, 1/4W (EFF REV T)	745-7950-540
RT1	RESISTOR, THERMAL, NEGATIVE COEFFICIENT, 10,000 OHMS ±10%, 1/2W	714-3255-020
S1	PART OF SWITCH BOARD ASSEMBLY	628-5527-001
S2	PART OF SWITCH BOARD ASSEMBLY	628-5527-001
S3	PART OF SWITCH BOARD ASSEMBLY	628-5527-001
S4	PART OF SWITCH BOARD ASSEMBLY	628-5527-001
S5	PART OF SWITCH BOARD ASSEMBLY	628-5527-001
S6	PART OF SWITCH BOARD ASSEMBLY	628-5527-001
T1	IF TRANSFORMER	278-0422-010
T2	INVERTER TRANSFORMER (EFF REV F)	664-0161-020
T2	INVERTER TRANSFORMER	664-0161-020
U1	INTEGRATED CIRCUIT, SILICON MONOLITHIC IF AMPLIFIER, 1350P	351-1134-020
U2	INTEGRATED CIRCUIT, SILICON MONOLITHIC IF AMPLIFIER, 1350P	351-1134-020
U3	INTEGRATED CIRCUIT, TTL MONOSTABLE MULTIVIBRATOR, 74121	351-1187-010
U4	INTEGRATED CIRCUIT, MOS ARRAY, CUSTOM ENCODER/ DECODER	351-8271-010
U5	INTEGRATED CIRCUIT, CMOS, QUAD 2 INPUT NAND GATE	351-1185-010
U6	INTEGRATED CIRCUIT, SILICON NPN 5-TRANSISTOR ARRAY, 3086 (EFF REV H)	351-1136-010
V1	CATHODE PULSED L BAND OSCILLATOR, RCA 4691 (TDR-950L)	277-0446-010
V1	CATHODE PULSED L BAND OSCILLATOR, GE C2080 (TDR-950L)	277-0446-040

PARTS LIST
TDR-950/950L TRANSPONDER
PART NUMBER 628-5530-001

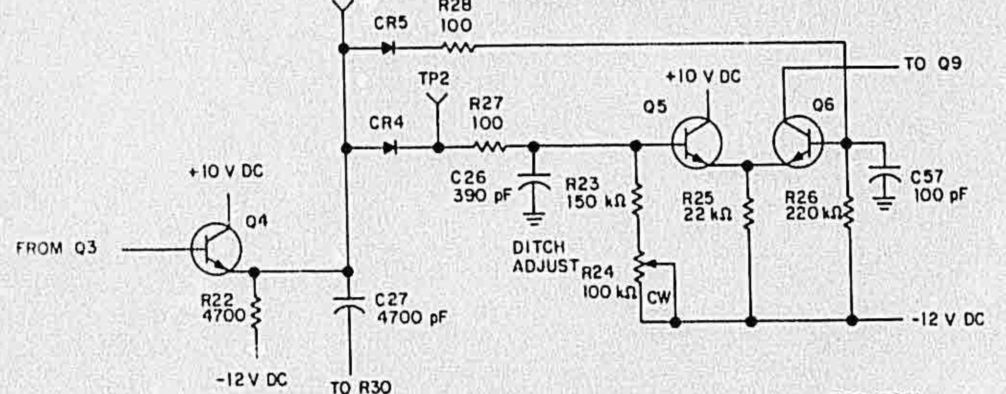
SYMBOL	DESCRIPTION	PART NUMBER
V1	CATHODE PULSED L BAND OSCILLATOR, RCA 4692 (TDR-950)	277-0446-020
V1	CATHODE PULSED L BAND OSCILLATOR, GE C2080A (TDR-950)	277-0446-030
VR1	DIODE, ZENER, 5.1V ±5%	353-3737-030
VR2	DIODE, ZENER, 12.0V ±5%	353-3737-120
VR3	DIODE, ZENER, 5.6V, 5% (EFF REV AB)	353-3737-050
Y1	CRYSTAL, QUARTZ, 136.25000MHZ	289-7226-010
Y2	CRYSTAL, QUARTZ, 3.0000MHZ	289-7254-020

PULSE WIDTH DISCRIMINATOR
BEFORE REV AA



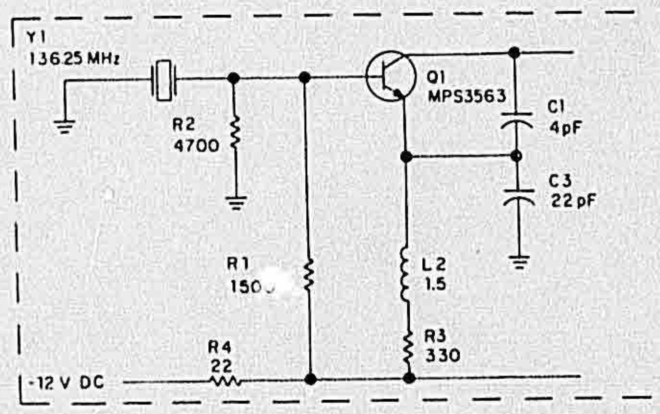
628-8003

VIDEO PROCESSOR



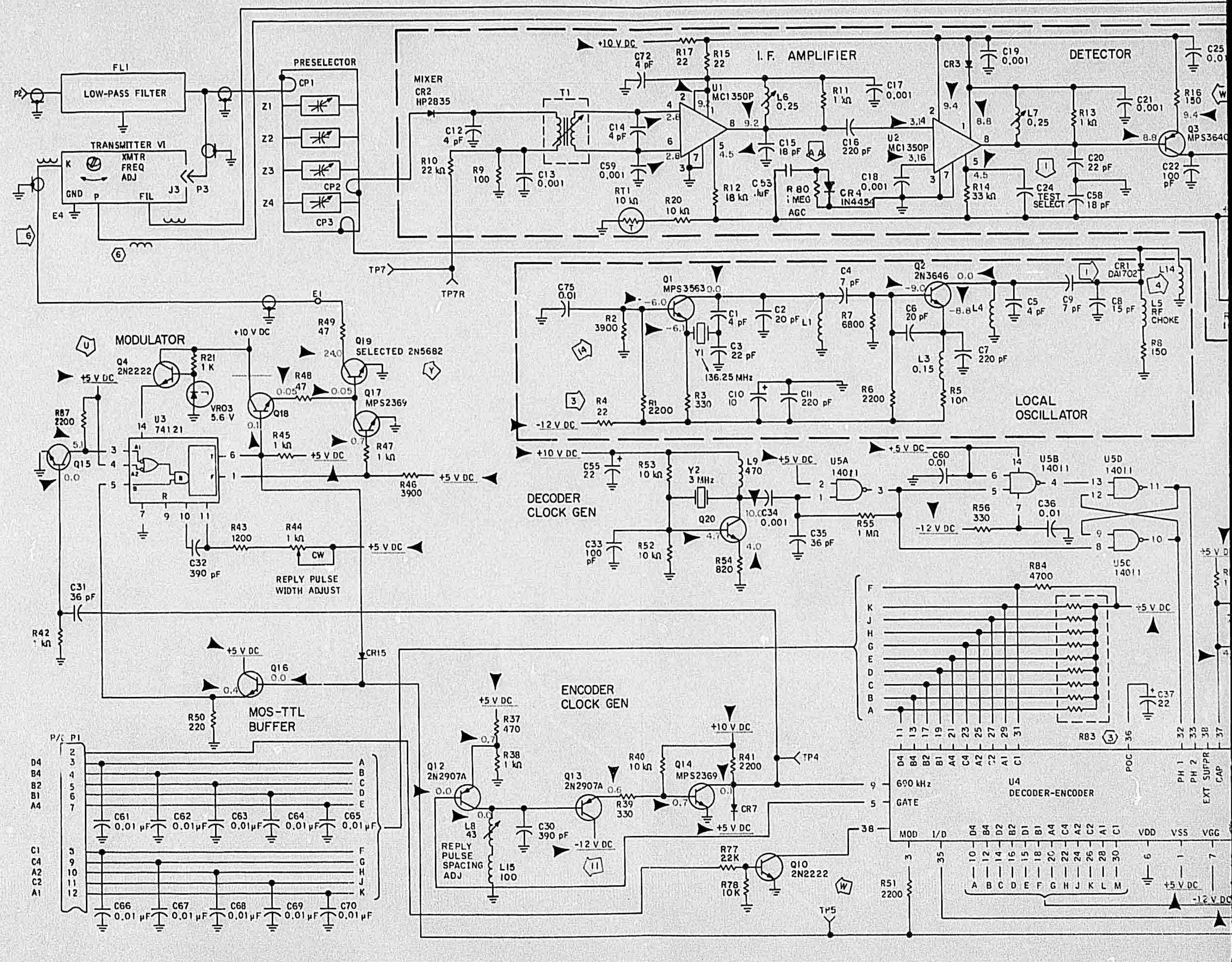
BEFORE REVISION H

628-6281
TP4-7323-013

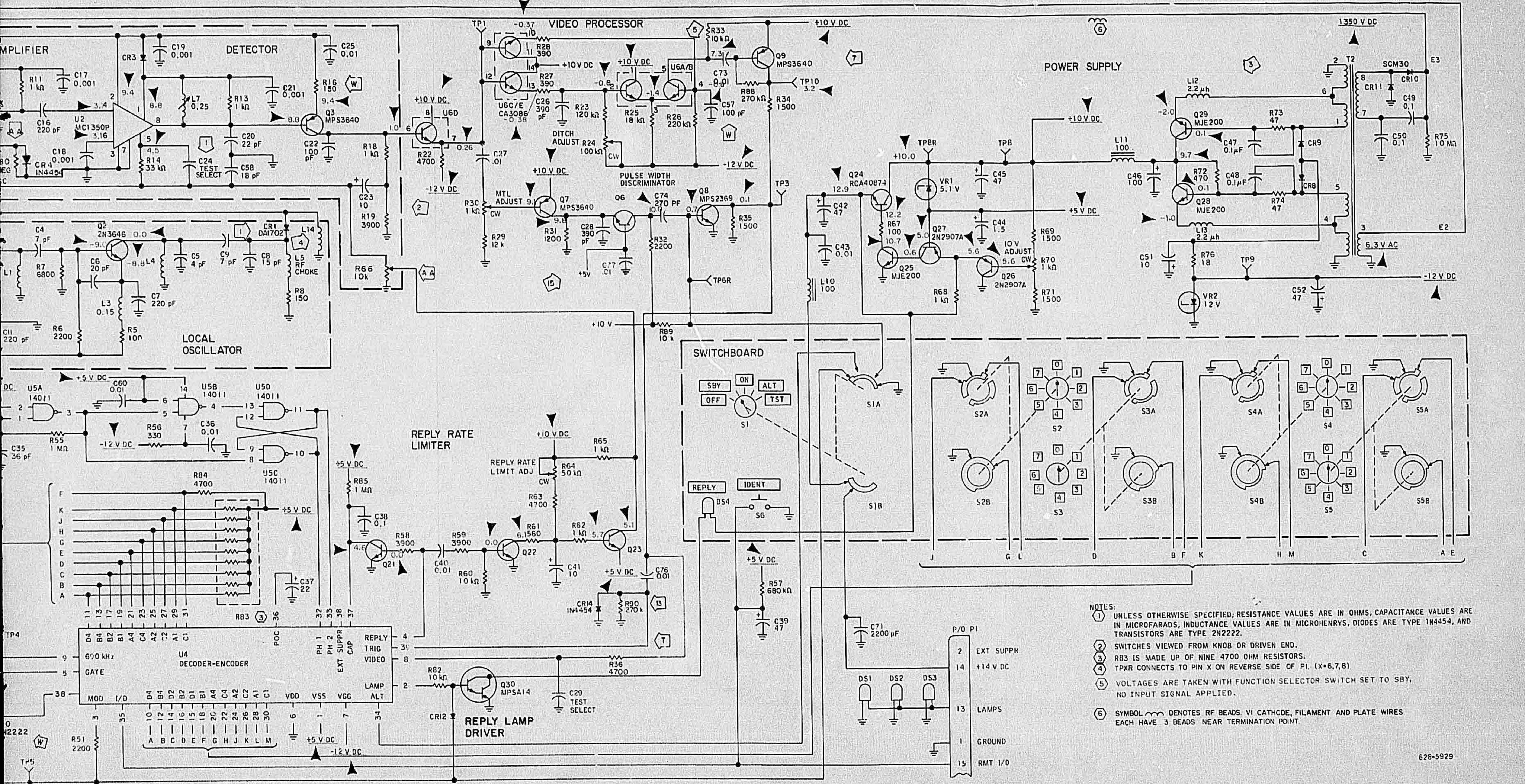


L.O. BEFORE REV Y

628-8002



SEE BLOW-UP FICHE NO. CLT102 - ITEM G



TDR-950/950L Transponder, Schematic Diagram
Figure 6-11

SEE BLOW-UP FICHE NO. CLT102 - ITEM G

Revised 1 August 1984

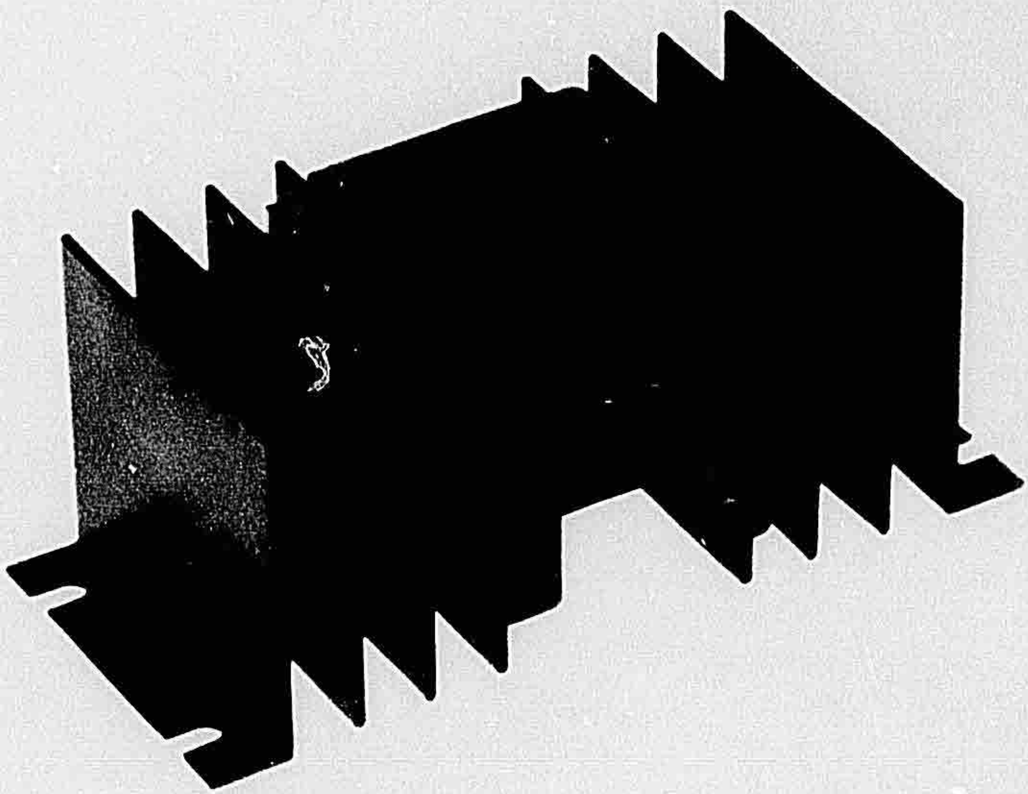
Collins General Aviation Division
Cedar Rapids, Iowa 52498

Rockwell
International

instruction book supplement

MICRO LINE

Collins 28- to 14-V DC Adapter



628-8162

523-0769630-00211J

7-84

Printed in U.S.A.

section I
description

1.1 INTRODUCTION

This supplement contains all the specifications, installation instructions, and maintenance information necessary to install and maintain the Collins 28- to 14-V dc Adapter, Collins part number 628-7990-001.

1.2 PURPOSE OF THE EQUIPMENT

The purpose of the 28- to 14-volt adapter is to provide regulated power to selected Collins Micro Line units installed in 28-volt systems; prior to adapter availability, these units required dropping resistors when installed in 28-volt aircraft. The adapter is specifically designed for use with the Collins AMR-350/350H Audio/Marker Panel, AUD-250/250H/251H Audio Panel, GLS-350/350E Glideslope Receiver, RCR-650/650A Receiver (part of the ADF-650/650A Automatic Direction Finder System), TDR-950/950L Transponder, and VIR-350/351 Navigation Receiver. Benefits derived from utilization of this adapter in 28-volt systems include improved performance and reliability.

1.3 DESIGN FEATURES

- Simple design for maximum reliability.
- Compact size, light weight, and remote mounting in any position for ease of installation.
- Elimination of dropping resistors contributes to improved performance and reliability of the associated equipment.

1.4 EQUIPMENT SPECIFICATIONS

Table 1-1 lists the equipment specifications for the 28- to 14-volt adapter.

Table 1-1. 28- to 14-Volt Adapter, Equipment Specifications.

CHARACTERISTICS	SPECIFICATIONS
Physical	
Dimensions	
Width	57.91 mm (2.28 in).
Height	50.80 mm (2.00 in).
Length	121.16 mm (4.77 in).
Mounting	Secured to airframe in any position, no mounting tray required.
Weight	0.22 kg (0.48 lb).
Environmental	
Temperature range	−40 to +55 °C (−40 to +131 °F).
Altitude	7 620 m (25 000 ft).
Cooling	Convection.
Relative humidity	95% at +50 °C (+122 °F) for 48 hours.

Table 1-1. 28- to 14-Volt Adapter, Equipment Specifications(Cont).

Shock	
Operational	15 g.
Crash safety	30 g.
Electrical	
Power requirements	27.5 V dc ±10% at 2 A maximum.
Output voltage	12.5 V dc ±10% for load current range of 0.26 to 1.3 A and 22 to 33 V dc line voltage.
Rated output current	1.3 A continuous.
Input current consumption	Equals output current plus 100 mA maximum.
Voltage regulation	±10% maximum change over 0.26 to 1.3 A load current and 22 to 33 V dc line voltage.

1.5 EQUIPMENT SUPPLIED

Included with the 28- to 14-volt adapter are three terminals, CPN 304-1551-020, for wiring harness termination at the adapter.

1.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Four #6 panhead screws and flat washers are required to secure the 28- to 14-volt adapter in place.

section II
installation

2.1 GENERAL

This section contains all the information necessary to install the 28- to 14-volt adapter in an aircraft and to ensure operational readiness after installation.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Unpack the equipment carefully and make a visual inspection of each unit for possible shipping damage. All claims for damage should be filed with the transportation company involved. If claims for damage are to be filed, save the original shipping carton and materials. If no defects can be detected, replace packing materials in the shipping container and save for future uses such as storage or reshipment.

2.3 SPECIAL INSTRUCTIONS

The 28- to 14-volt adapter radiates heat. When selecting a mounting position, ensure that adequate air circulation is provided for cooling.

2.4 INSTALLATION PROCEDURES

The following installation procedures must be performed as described to ensure proper operation and performance.

a. Avoid mounting the adapter close to temperature-sensitive equipment.
b. Rigidly mount the adapter to the airframe. Mounting may be in any convenient location or position where adequate air circulation is available. Use four #6 panhead screws and flat washers to secure the adapter in place.
c. Refer to figure 2-1 for adapter outline and mounting dimensions.

2.5 CABLING

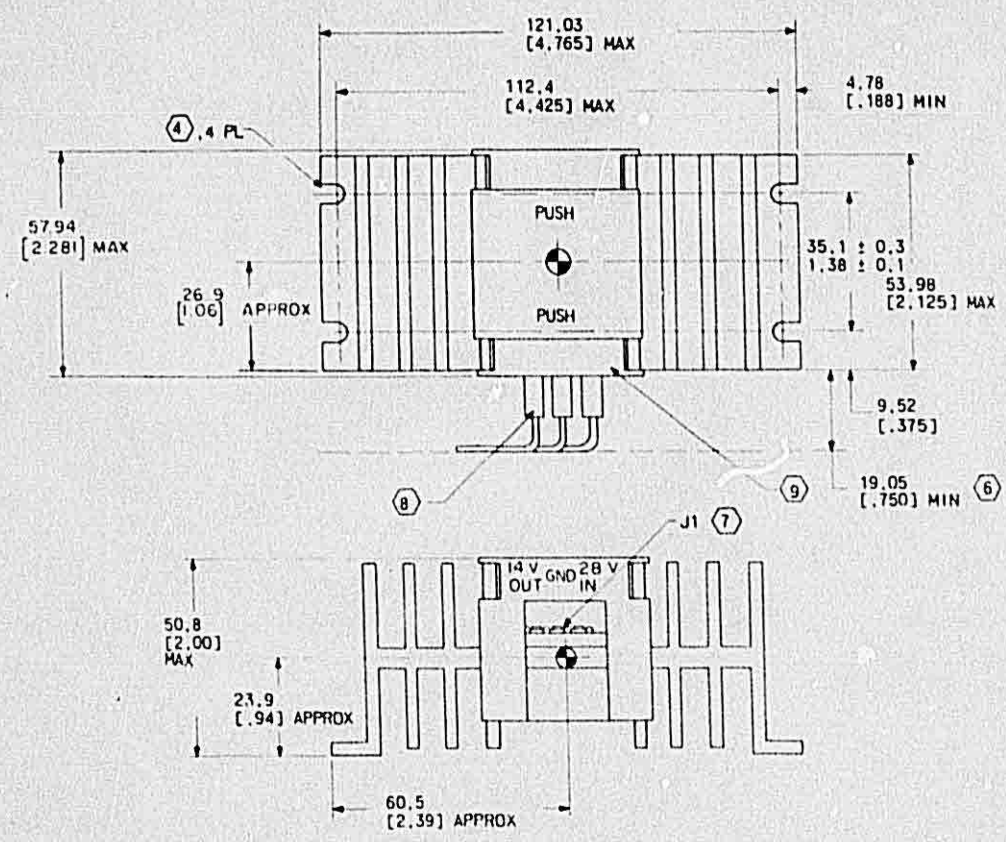
All connections to the 28- to 14-volt adapter are made through the terminal block located on the side of the unit. Crimp-type terminals are included with the adapter for ease of installation. Refer to figure 2-1 for terminal board lug assignments. Figure 2-2 shows partial interconnect wiring diagrams for those units that may be used with the adapter. During preparation of the interconnect wiring cables, observe the following precautions:

a. Be sure to observe the minimum specified wire gage sizes included on the interconnect wiring diagrams.
b. When preparing the wiring harness, use an AMP crimping tool (AMP No 47386, CPN 304-8003-020) to fasten the harness wires to the terminals provided with the adapter.
c. When fastening the wiring harness to the adapter terminal board, use the unit cover labeling as a guide in selecting the correct input and output terminals.

2.6 POSTINSTALLATION CHECKS

Postinstallation checks are to be performed with the 28- to 14-volt adapter and its associated equipment installed in the aircraft. Checks should be made using the aircraft power supply with the engine running.

a. Set the radio master switch to OFF if the aircraft is equipped with this feature. All individual units equipped with an ON/OFF control should be switched to OFF.
b. Start the aircraft and switch the radio master to ON after engine(s) is (are) running smoothly.
c. Perform the postinstallation test procedures for each unit for which power is supplied by the 28- to 14-volt adapter.

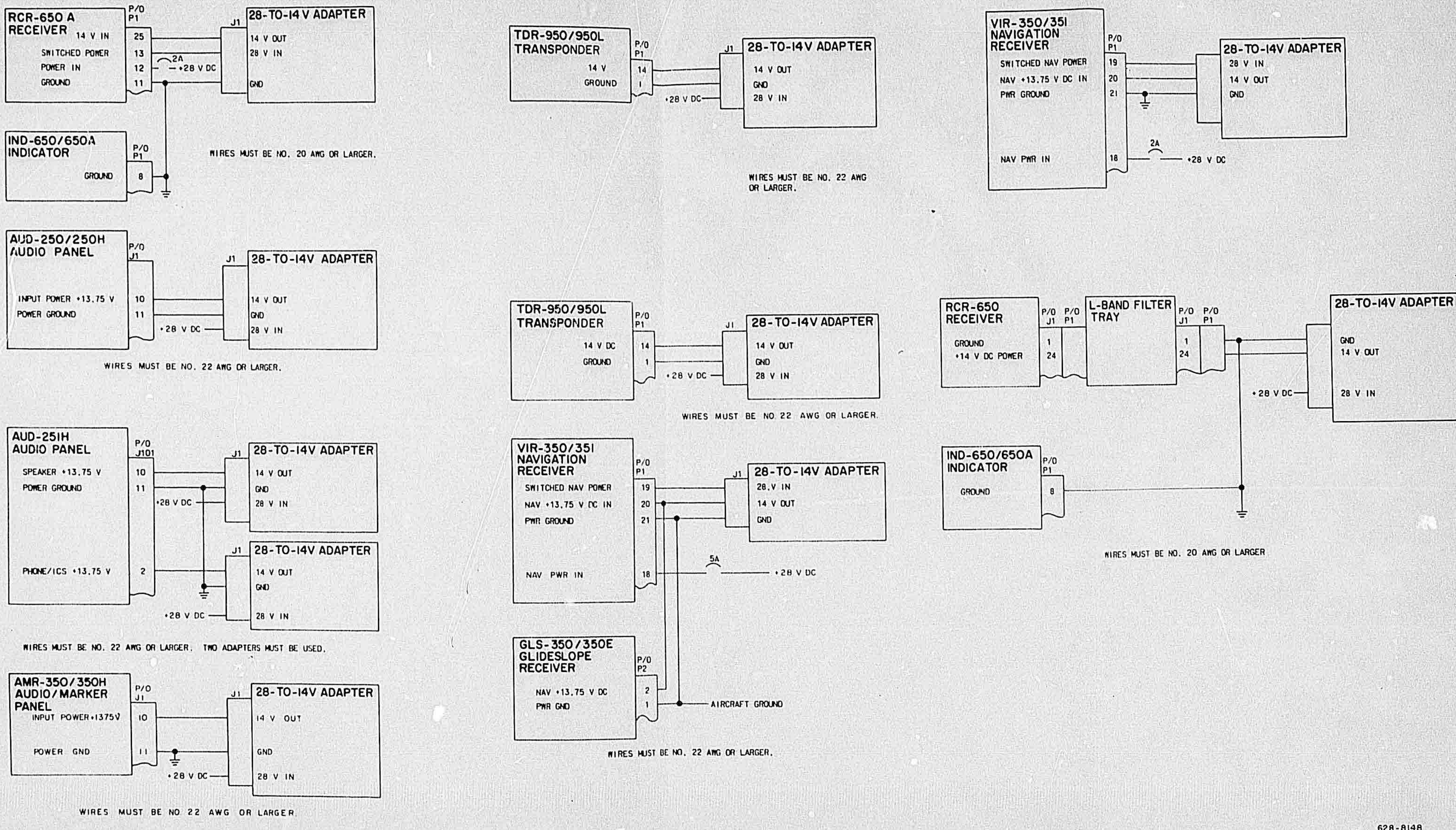


NOTES:

1. DIMENSIONS ARE IN MILLIMETERS [INCHES].
2. WEIGHT: 0.22 KG [.48 LB]
3. THIS DRAWING APPLIES TO 628-7990-001
4. SLOTS PROVIDED FOR MOUNTING UNIT. USE NO. 6 PAN HEAD SCREW AND FLAT WASHER (NOT SUPPLIED).
5. DENOTES CENTER OF GRAVITY.
6. RECOMMENDED CLEARANCE FOR TERMINALS AND WIRES.
7. UNIT CONNECTOR J1 IS A TRW/CINCH 172 SERIES BARRIER BLOCK 351-27-03-001 (CPN 367-1887-020).
8. TERMINALS FOR UNIT CONNECTOR J1, SUPPLIED WITH UNIT, ARE TYPED 320773 FOR 22-16 AWG WIRE AND NO. 2 STUD MANUFACTURED BY AMP INCORPORATED (CPN 304-1551-020). USE AMP INC. CRIMP TOOL NO. 47386 (CPN 304-8003-020).
9. UNIT COVER MUST BE REMOVED TO INSTALL TERMINALS ON J1 CONNECTOR. WHEN INSTALLING COVER PRESS WITH FINGER IN AREA NOTED ON COVER (2) TWO PLACES UNTIL SNAP LOCK IS FELT.

628-8072

28- to 14-Volt Adapter, Outline and Mounting Dimensions
Figure 2-1



Partial Interconnect Wiring Diagrams
Figure 2-2

section III
maintenance

3.1 GENERAL

This section provides the information necessary to maintain, repair, and test the 28- to 14-volt adapter.

The 28- to 14-volt adapter requires no routine maintenance other than periodic inspections to ensure the unit has not sustained physical damage.

3.2 TEST EQUIPMENT

Table 3-1 lists the equipment required to test, troubleshoot, and repair the 28- to 14-volt adapter.

3.3 PERFORMANCE TEST

Test procedures are performed using the test setup shown in figure 3-1. The load placed on the 28- to 14-volt adapter will vary for different tests; these loads are noted in the appropriate test.

Caution

During testing the adapter may become too hot to touch with unprotected hands. Be careful to avoid burns when handling.

a. Connect the test equipment to the 28- to 14-volt adapter as shown in figure 3-1. Use the 10-ohm, 30-watt resistor as a load.
b. Increase power supply output until voltmeter indicates 22.0 V dc, and observe oscilloscope. Result: output ripple is less than 20 mV p-p.
c. Without changing power supply output, measure adapter output voltage at 14 V OUT. Result: adapter output voltage is 12.5 V dc ±10%.
d. Increase power supply output level to 33.0 V dc, and observe adapter output voltage. Result: adapter output voltage is 12.5 V dc ±10%.
e. Observe adapter output ripple on oscilloscope. Result: output ripple is less than 20 mV p-p.
f. Remove 10-ohm resistor and replace with 51-ohm, 6-watt load resistor. Observe adapter output level. Result: adapter output voltage is 12.5 V dc ±10%.
g. Observe voltage ripple across load resistor. Result: ripple is less than 20 mV p-p.
h. Decrease power supply output level to 22.0 V dc, and observe adapter output voltage at 14 V OUT. Result: adapter output voltage is 12.5 V dc ±10%.
i. Observe voltage ripple across load resistor. Result: ripple is less than 20 mV p-p.

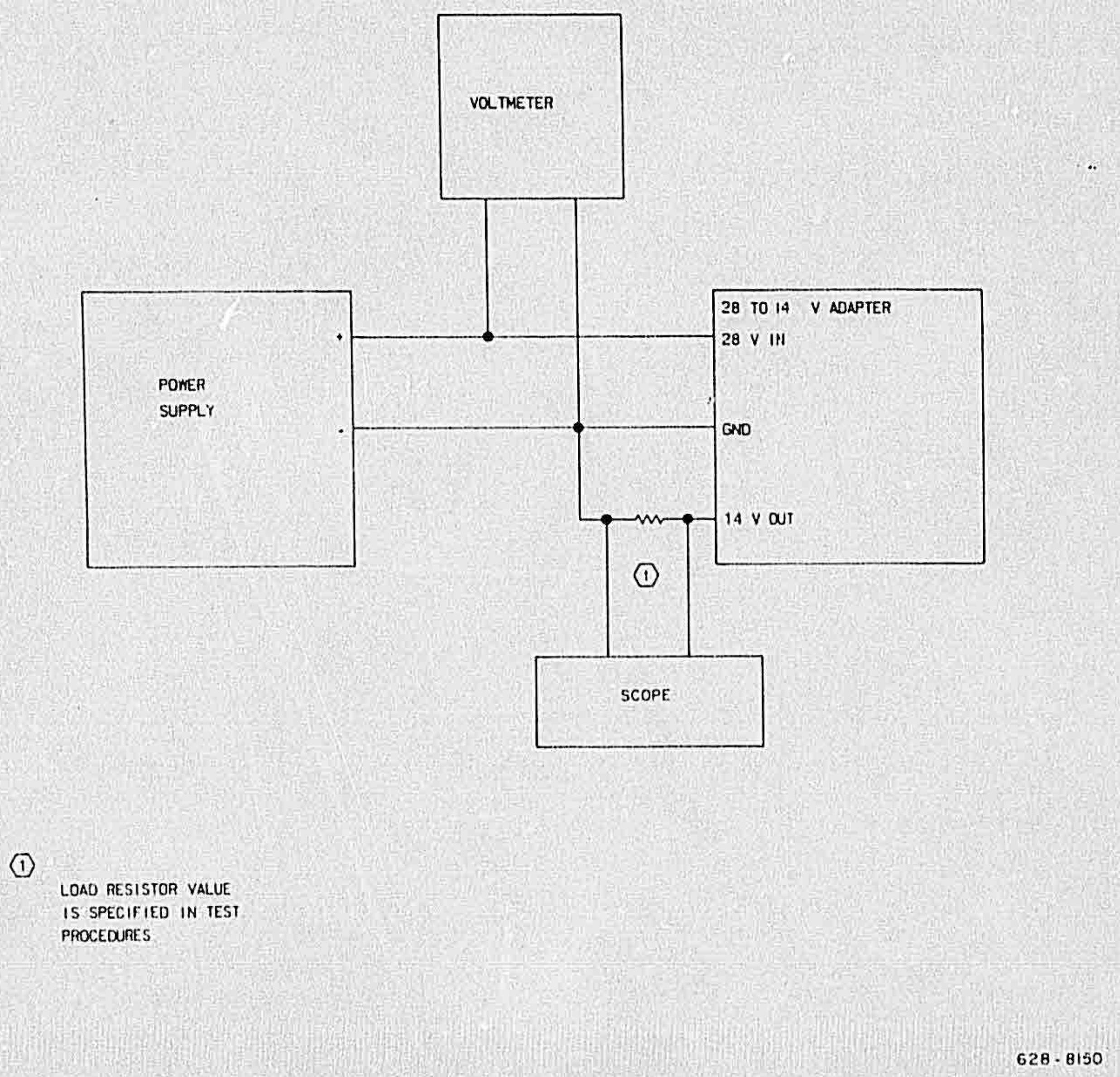
Table 3-1. Test Equipment Required.

EQUIPMENT	CHARACTERISTICS REQUIRED	REPRESENTATIVE TYPE
Dc power supply	0 to 35 V dc (variable), 1.5 A	Any
Voltmeter	Input impedance: 1 megohm Range: 0 to 35 V dc	Fairchild 7000
Oscilloscope	Single or dual channel	Any
Resistor	10-ohm, 30-W minimum	Collins 747-2172-090
Resistor	51-ohm, 6-W minimum	Collins 747-2172-080

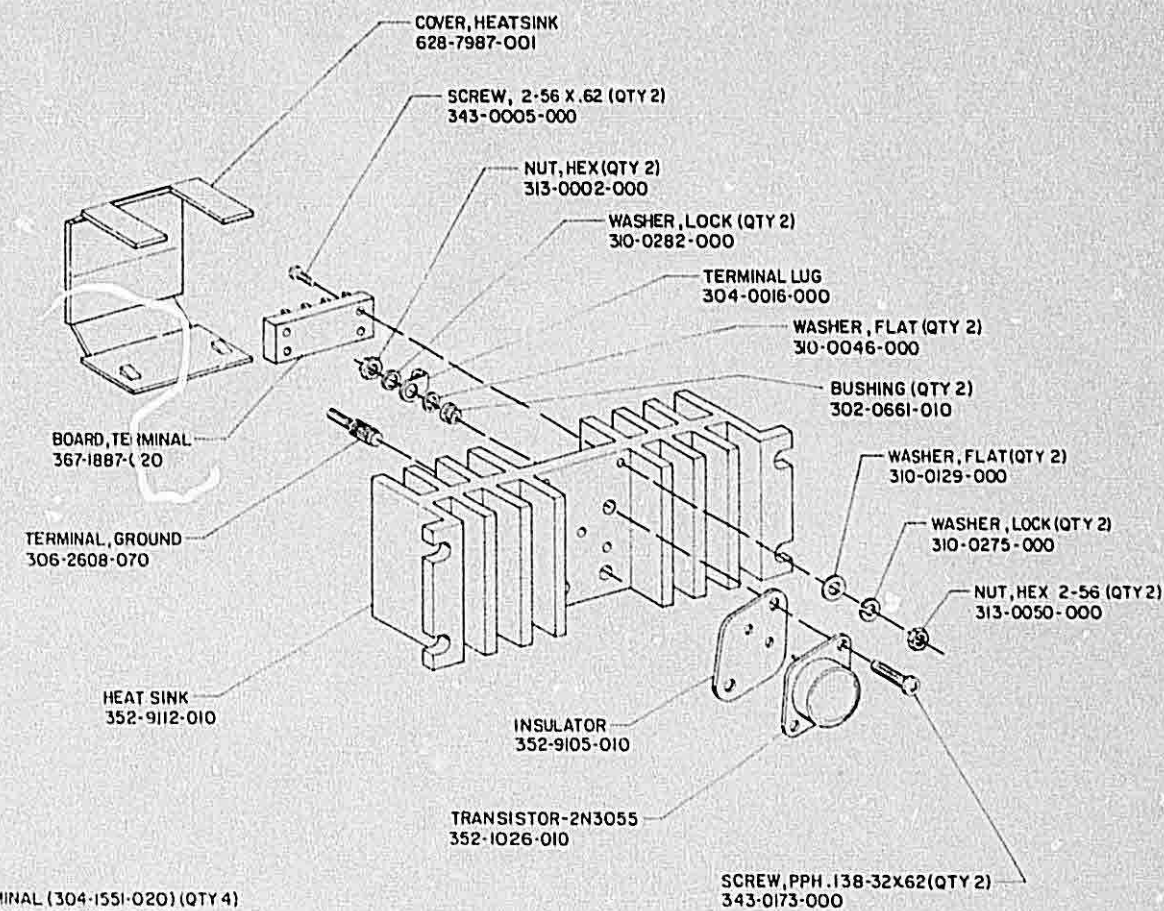
3.4 DISASSEMBLY/ASSEMBLY

The mechanical simplicity of the 28- to 14-volt adapter is illustrated in the exploded view shown in figure 3-2. There are no special procedures to be followed when disassembling the adapter. Reassembly, however, does require that the following special instructions be observed.

a. Heat-sink compound, Collins part number 005-1234-020 or equivalent, must be applied to both sides of the transistor mica insulator prior to reassembly. Remove any excess compound that is extruded when the transistor is tightened down.
b. Torque the nuts securing transistor Q1 in place 124.3 to 146.9 N•m (11 to 13 $lb_f \cdot in^2$).



Bench Test Setup
Figure 3-1



NOTE

(1) TERMINAL (304-1551-020) (QTY 4) SUPPLIED BUT NOT SHOWN.

628-8079

28- to 14-Volt Adapter, Exploded View
Figure 3-2

section IV
schematics

4.1 CONFIGURATION STATUS CONTROL

Collins General Aviation Division of Rockwell International uses the following method of identifying the configuration status of a unit or subassembly.

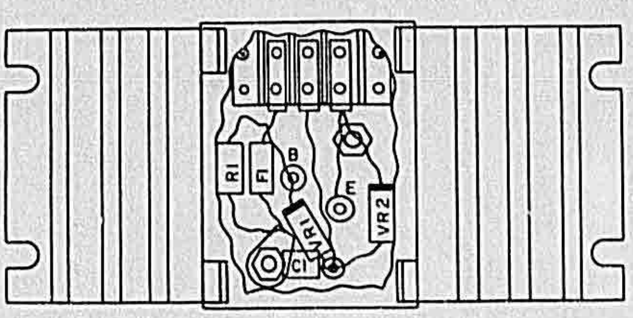
A 2-character maximum alphabetic identifier will be preceded by the letters REV (revision) and will start with — if no changes have been processed. The first change will be identified as A, the second as B, continuing through Z to AA, AB, and ultimately to ZZ. Incorporation of design changes in a unit or subassembly that has been returned to Rockwell-Collins for repair by a customer or that has been removed from the company's finished goods inventory is defined as rework. At the time of rework, the unit or subassembly will be marked again to reflect the design level to which it is being upgraded. This is done by leaving the original marking on the unit or subassembly and adding the letters RWK (rework) followed by the alphabetic identifier of the latest change incorporated in the rework. For example, if unit one is marked REV B — RWK F and unit two is marked REV F, this indicates that both units are at the design level of revision F, but unit one is reworked and they may not look exactly the same.

Note

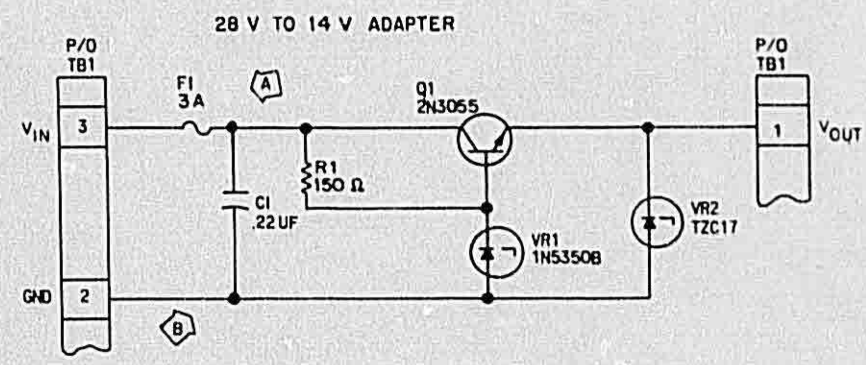
A reworked unit may not contain all design changes made to the reworked identifier but does contain all changes required to make unit operation identical to a newly manufactured unit with the same identifier. Therefore, a unit reworked to a specific identifier may appear physically different from a newly manufactured unit with the same alphabetic identifier.

4.2 SCHEMATIC DIAGRAM

The 28- to 14-volt adapter component location diagram and schematic are shown in figures 4-1 and 4-2 respectively.



28- to 14-Volt Adapter, Component Location Diagram
Figure 4-1



REFERENCE DESIGNATOR	DESCRIPTION	COLLINS PART NUMBER
C1	Capacitor, fxd, ceramic, 0.22 μf, 20%, 50V	913-3306-080
FL1	Fuse, 3A	264-0968-040
Q1	Transistor, 2N3055	352-1026-010
R1	Resistor, Fxd, WW, 150 ohm, 5%, 6.5 W	747-5498-000
TB1	Connector	367-1887-020
VR1	Zener Diode, 1N5350B	353-6550-180
VR2	Zener Diode, TZC 17	353-0314-020

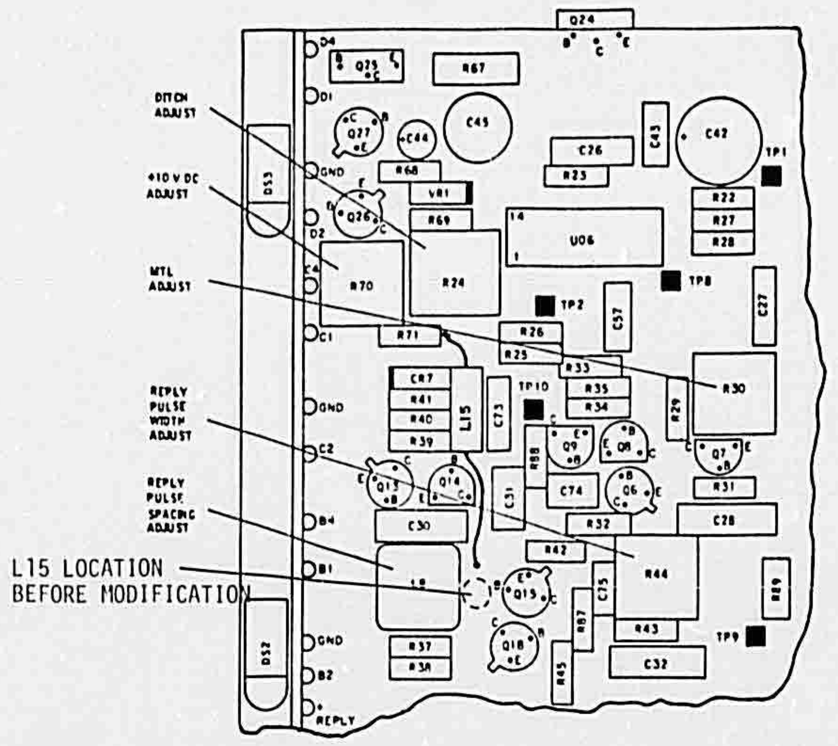
28- to 14-Volt Adapter, Schematic Diagram
Figure 4-2

Rockwell-Collins | SERVICE BULLETIN
Collins General Aviation Division/Rockwell International

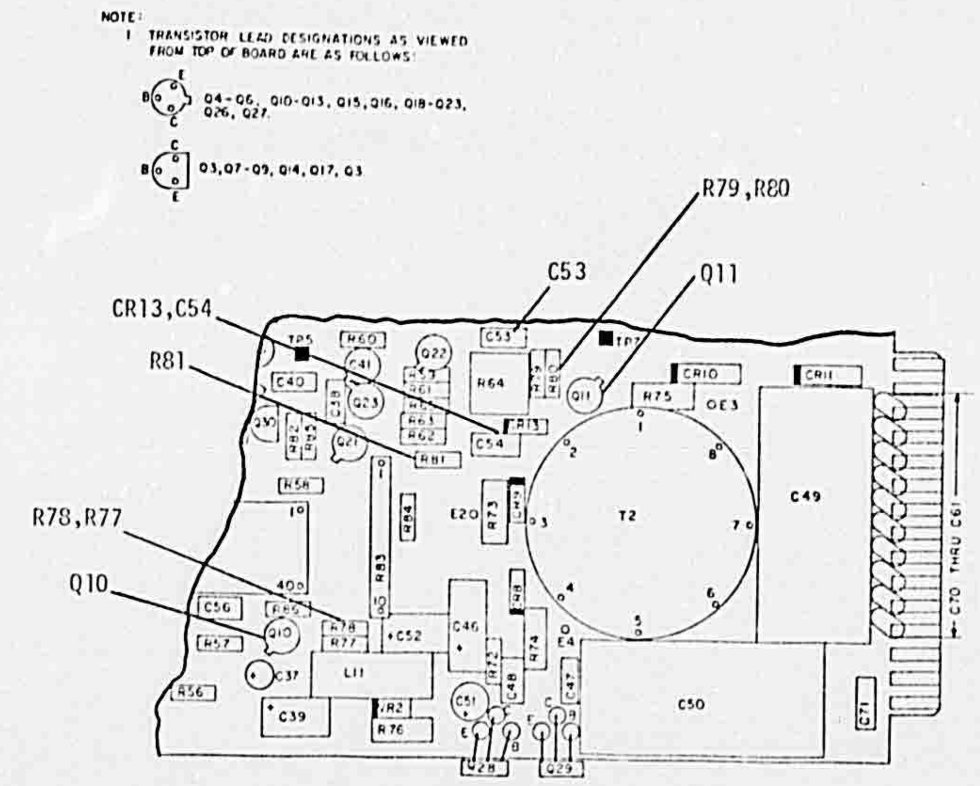
3. Material Information

The component required to modify one TDR-950 Transponder is listed below.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER
240-2747-320	1	$0.65	Inductor, 100 μh	240-2741-060

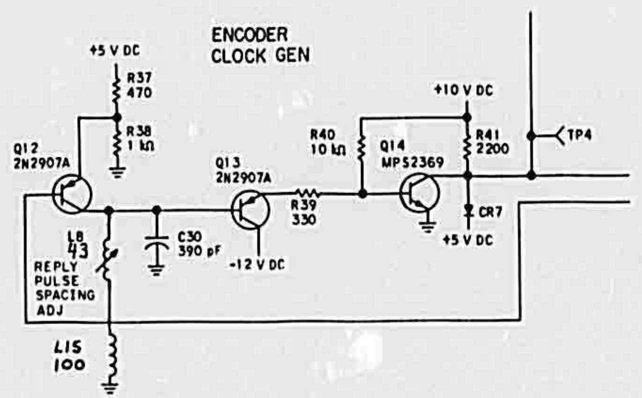


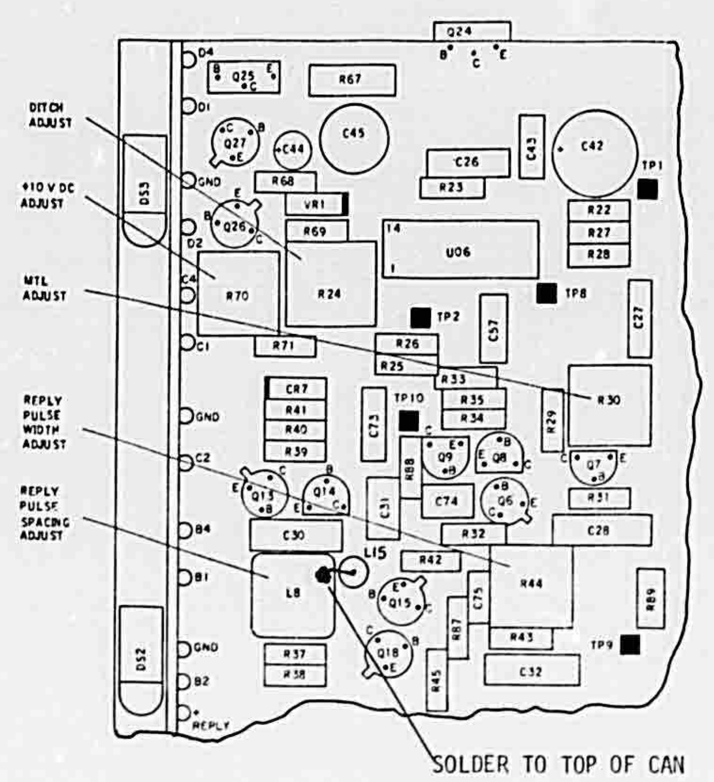
Collins | SERVICE BULLETIN



Partial Component Location Diagram of TDR-950/950L
Showing Suppression Circuitry
Figure 3

Collins | SERVICE BULLETIN





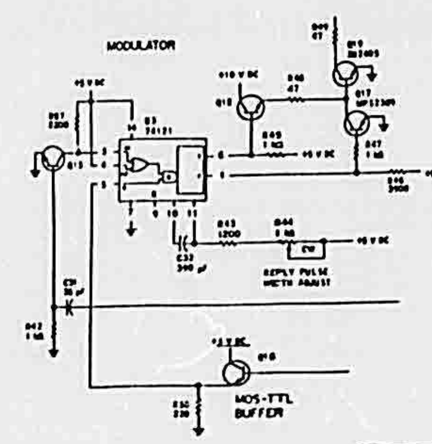
After Modification
Figure 3

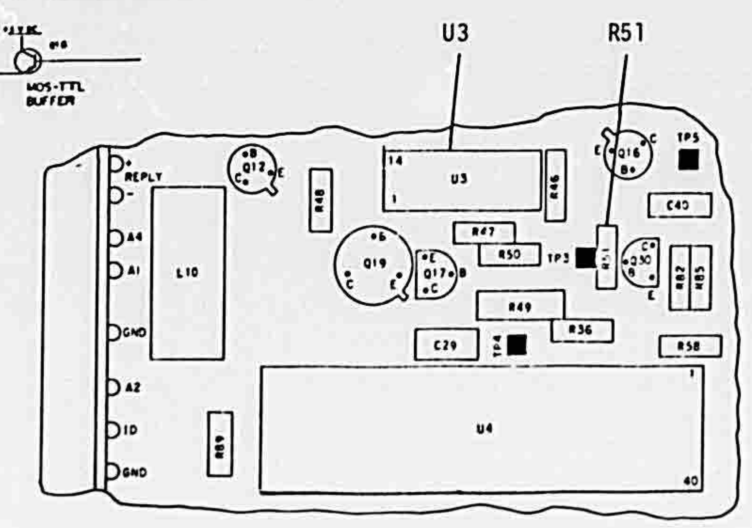
Rockwell-Collins | SERVICE BULLETIN
Collins General Aviation Division/Rockwell International

3. Material Information

The component required to modify one TDR-950/950L Transponder is listed below.

COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION
353-3741-010	1	$0.09	Diode, 1N4454

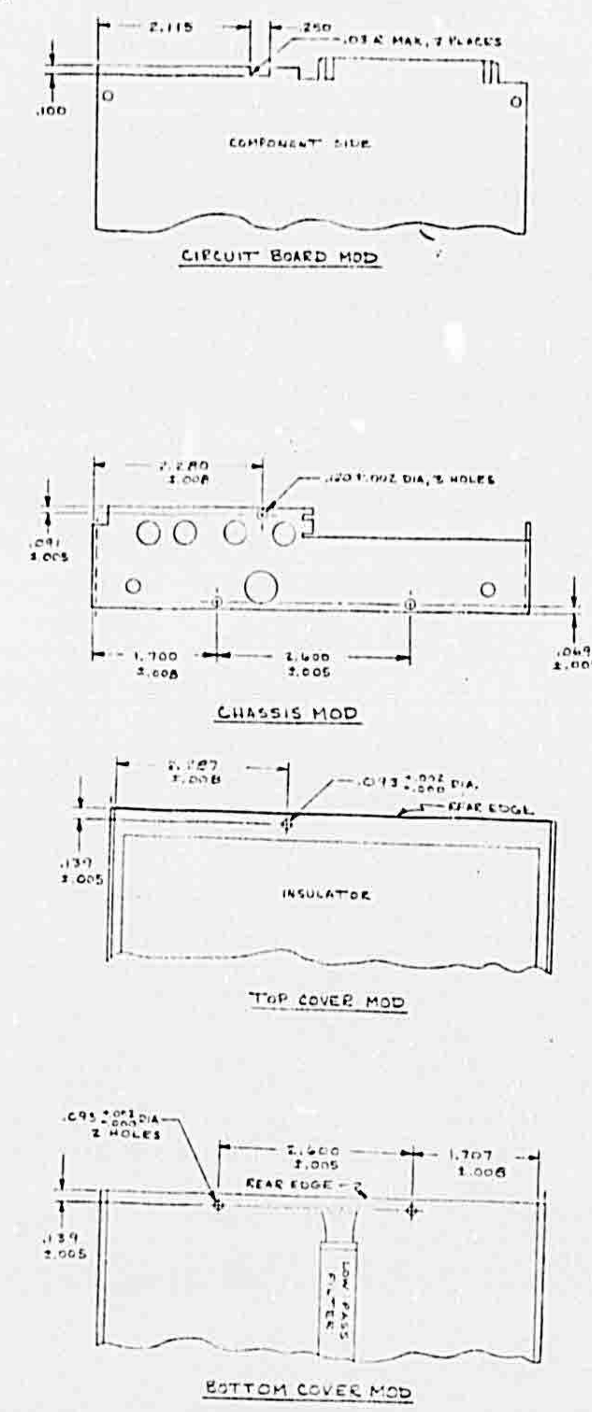




Before Modification
Figure 1

Collins | SERVICE BULLETIN

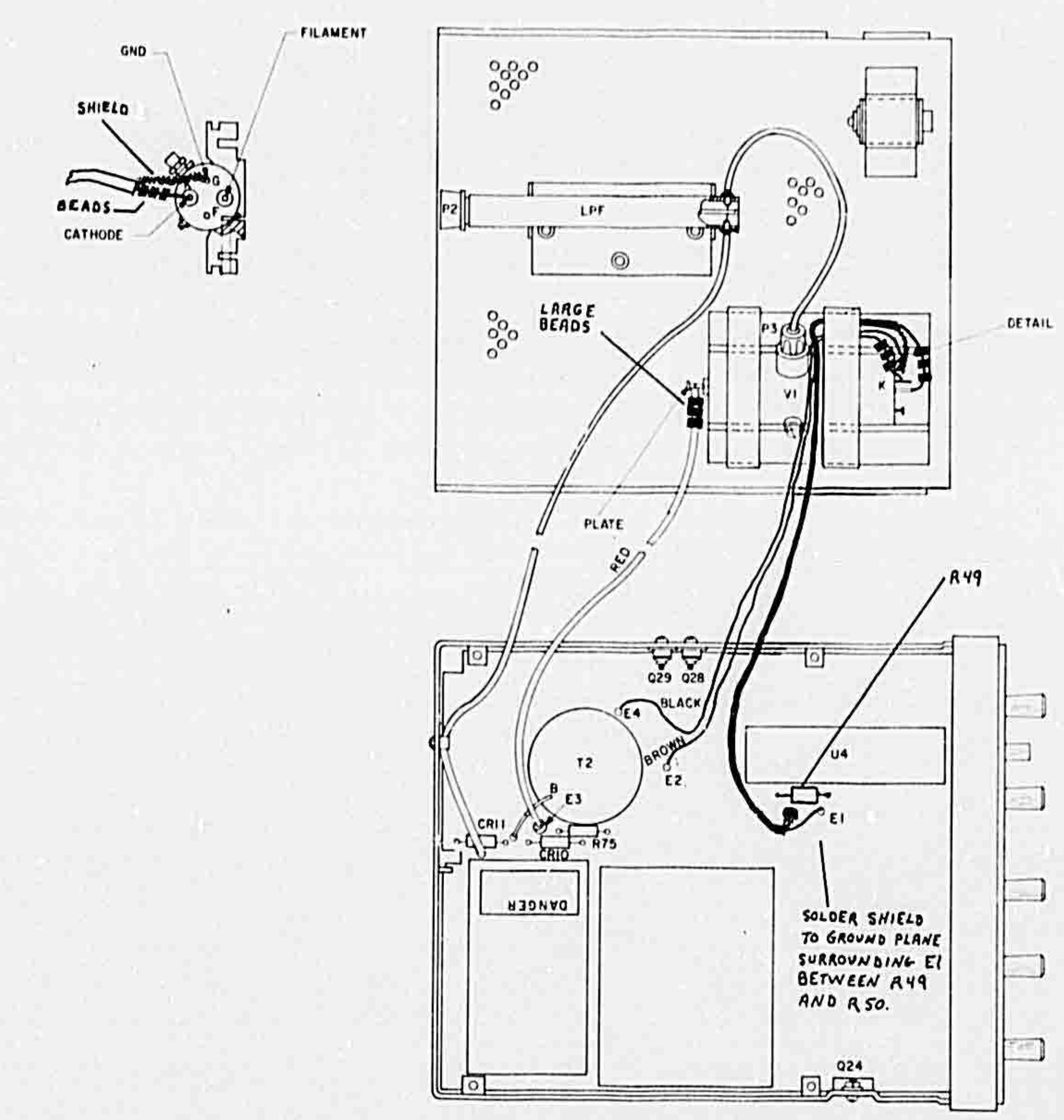
Collins Radio Group
Rockwell International



Hole Locations
Figure 1

Collins | SERVICE BULLETIN

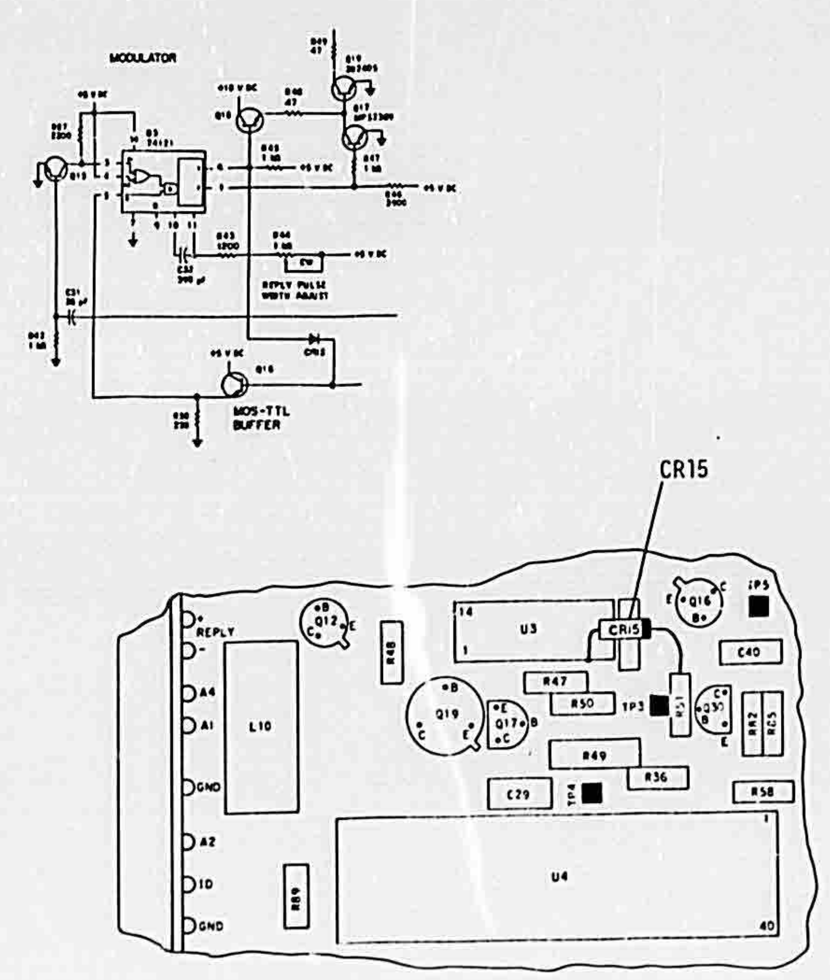
Collins Radio Group
Rockwell International



Electrical Modifications
Figure 3

Rockwell-Collins | SERVICE BULLETIN

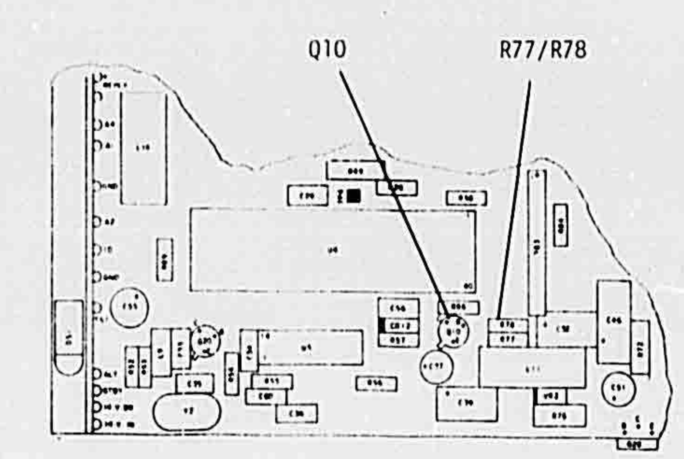
Collins General Aviation Division/Rockwell International



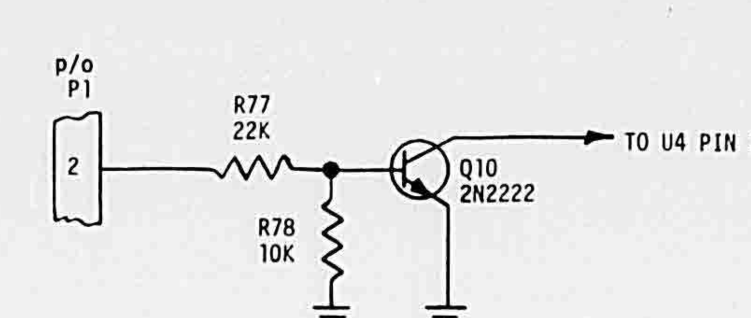
After Modification
Figure 2

Rockwell-Collins | SERVICE BULLETIN

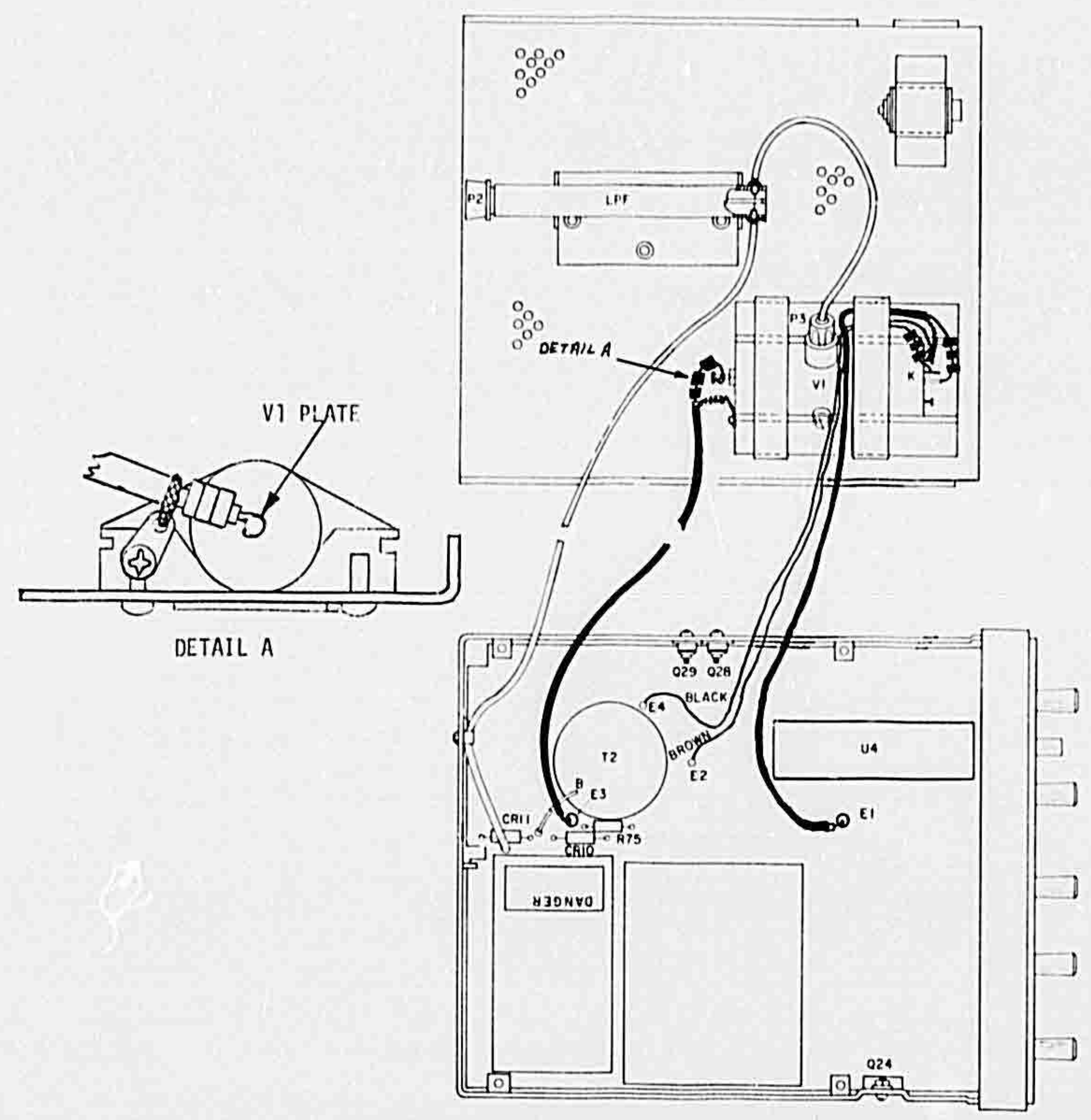
Collins General Aviation Division/Rockwell International



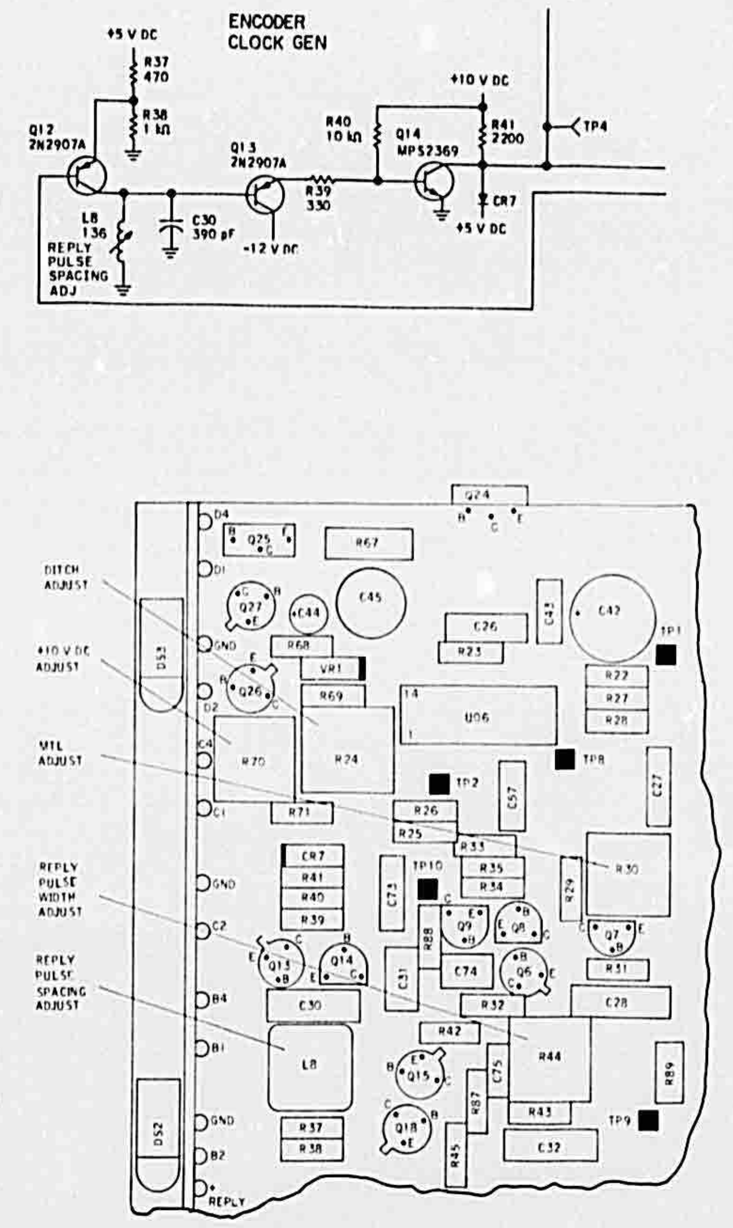
Partial Component Location Diagram
Figure 1



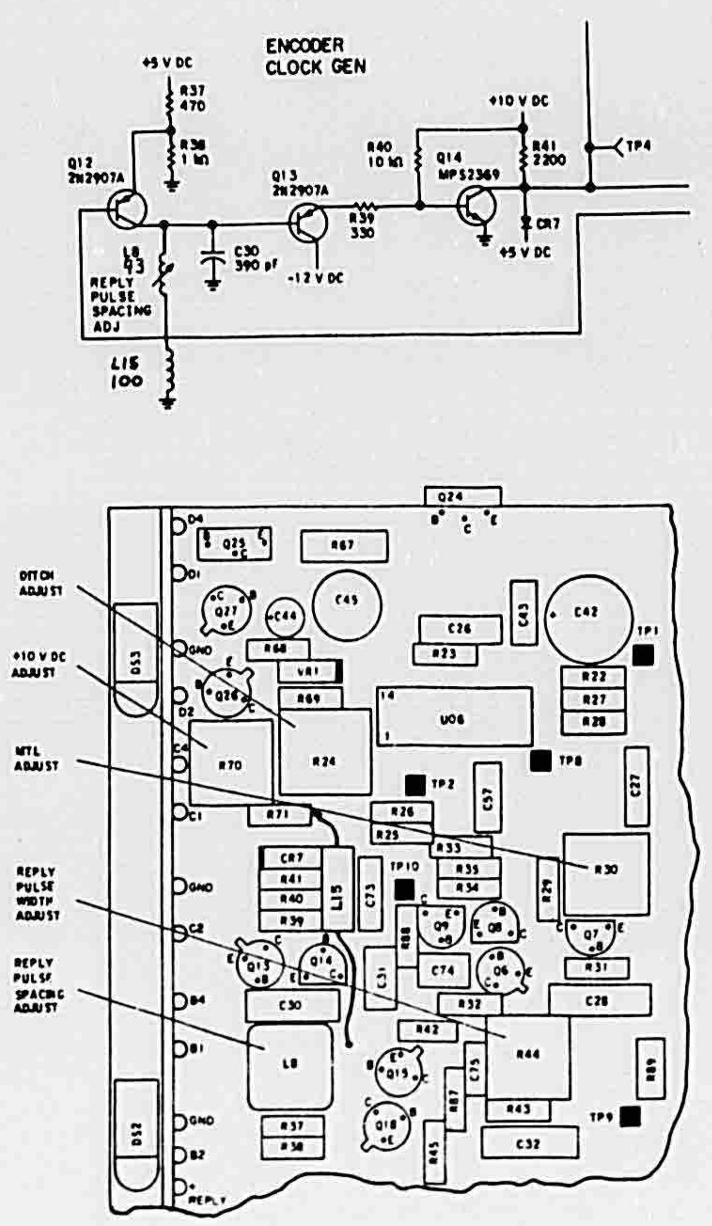
Electrical Modification
Figure 2



Chassis Wiring
Figure 2



Before Modification
Figure 2



After Modification

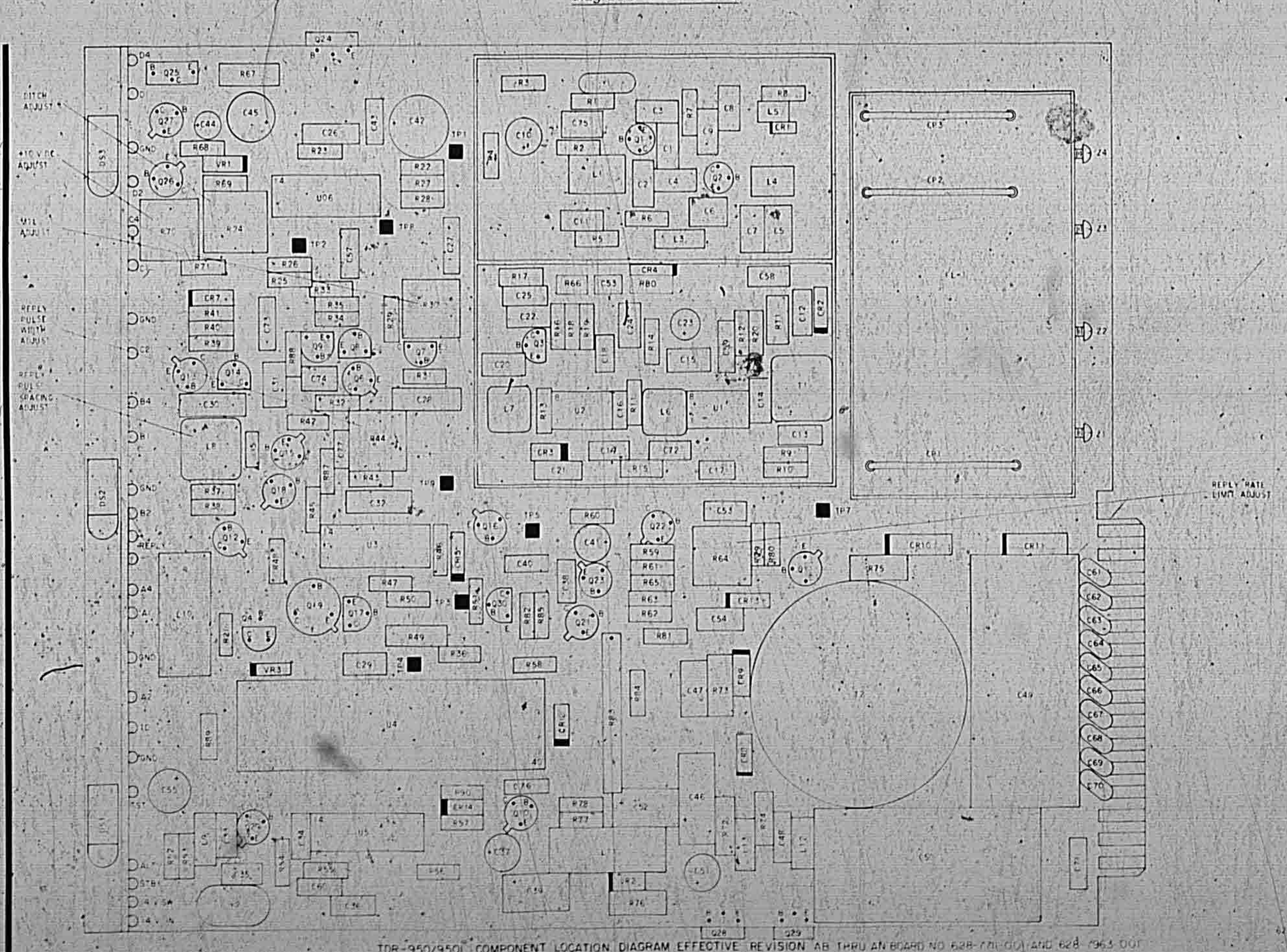
B

diagrams 523-0766470

TDR-950/950L Transponder, Component Location Diagram, REV's A Through S, Board No 628-5531-001
Figure 6-1

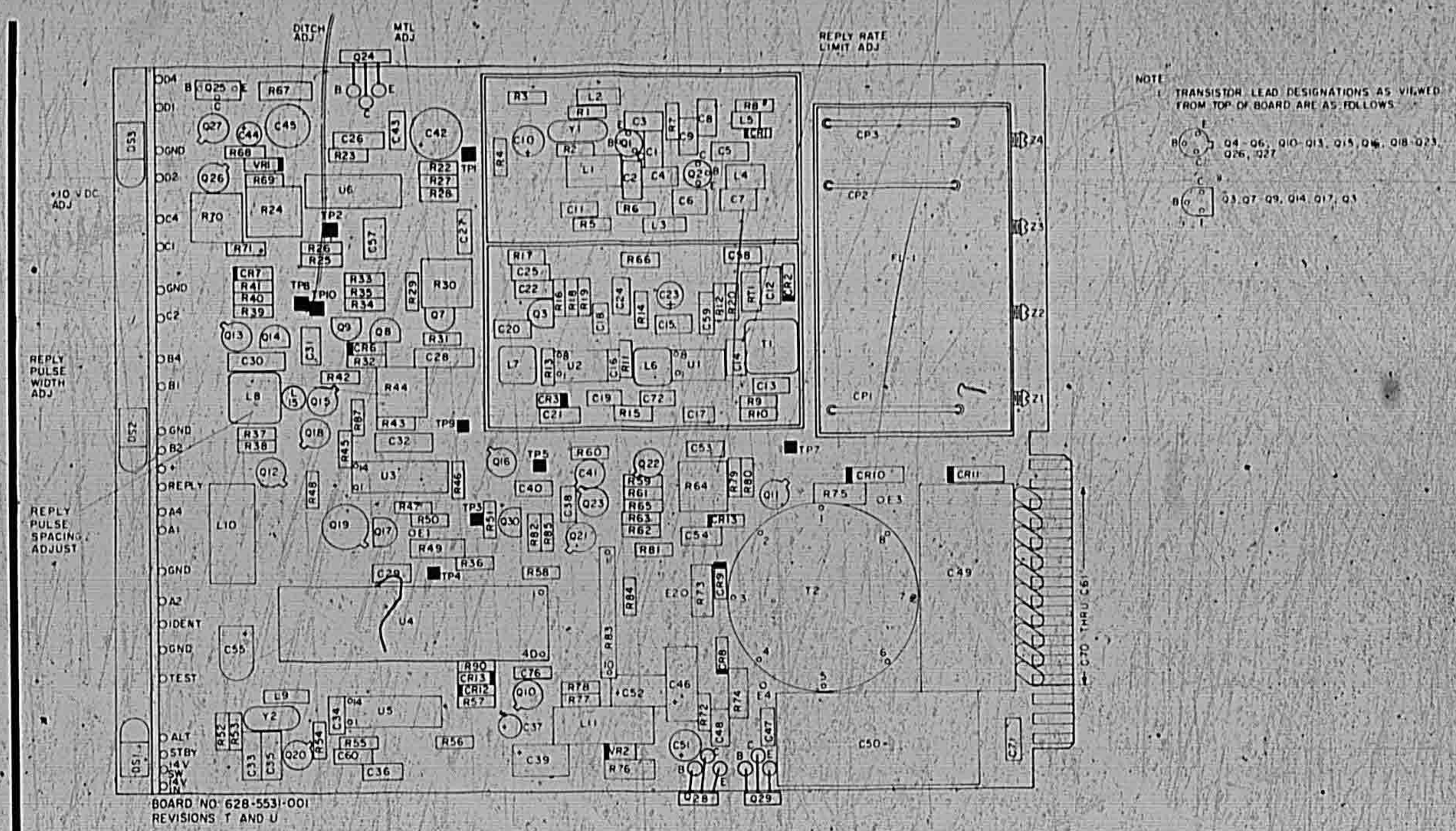
C

diagrams 523-0766470



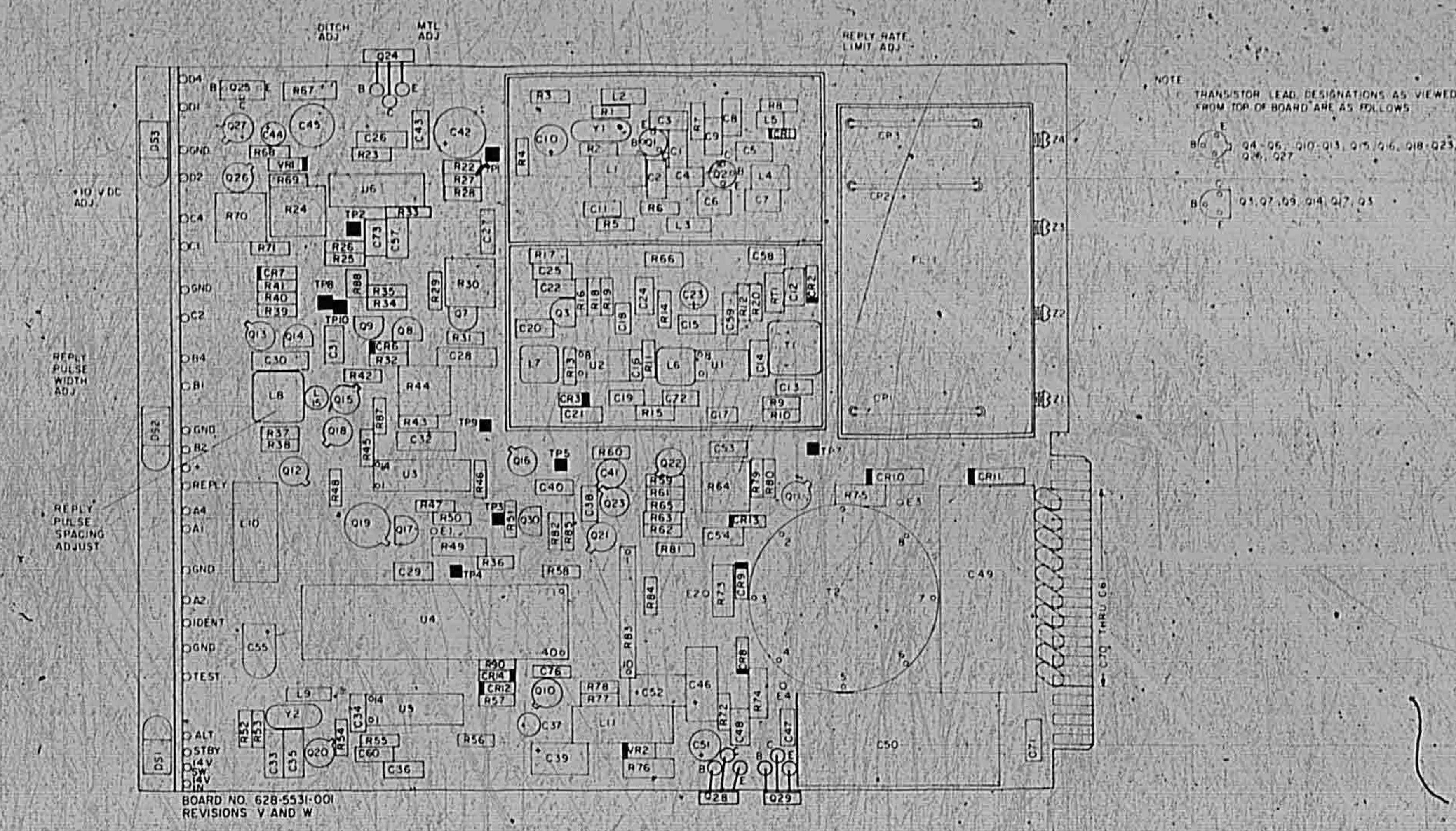
TDR-950/950L Transponder, Component Location Diagram, REV's AB through AN, Board No 628-7711-001 and 628-7963-001
Figure 6-6

E



TDR-950/950L Transponder, Component Location Diagram, REV's T and U, Board No 628-5531-001
Figure 6-2

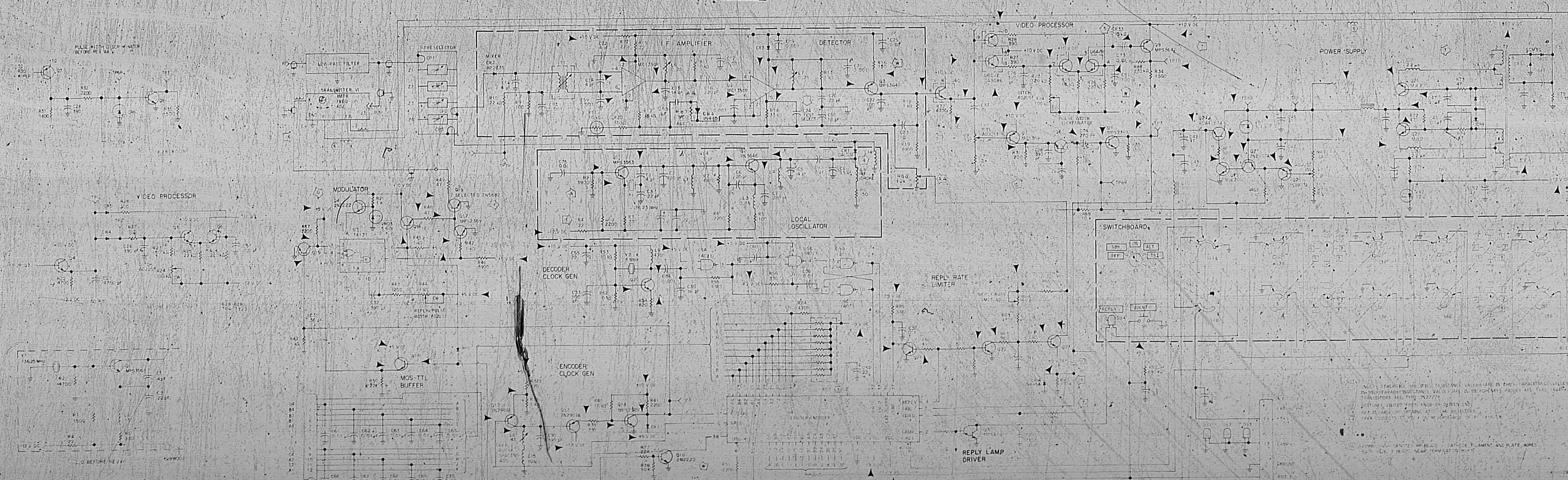
F



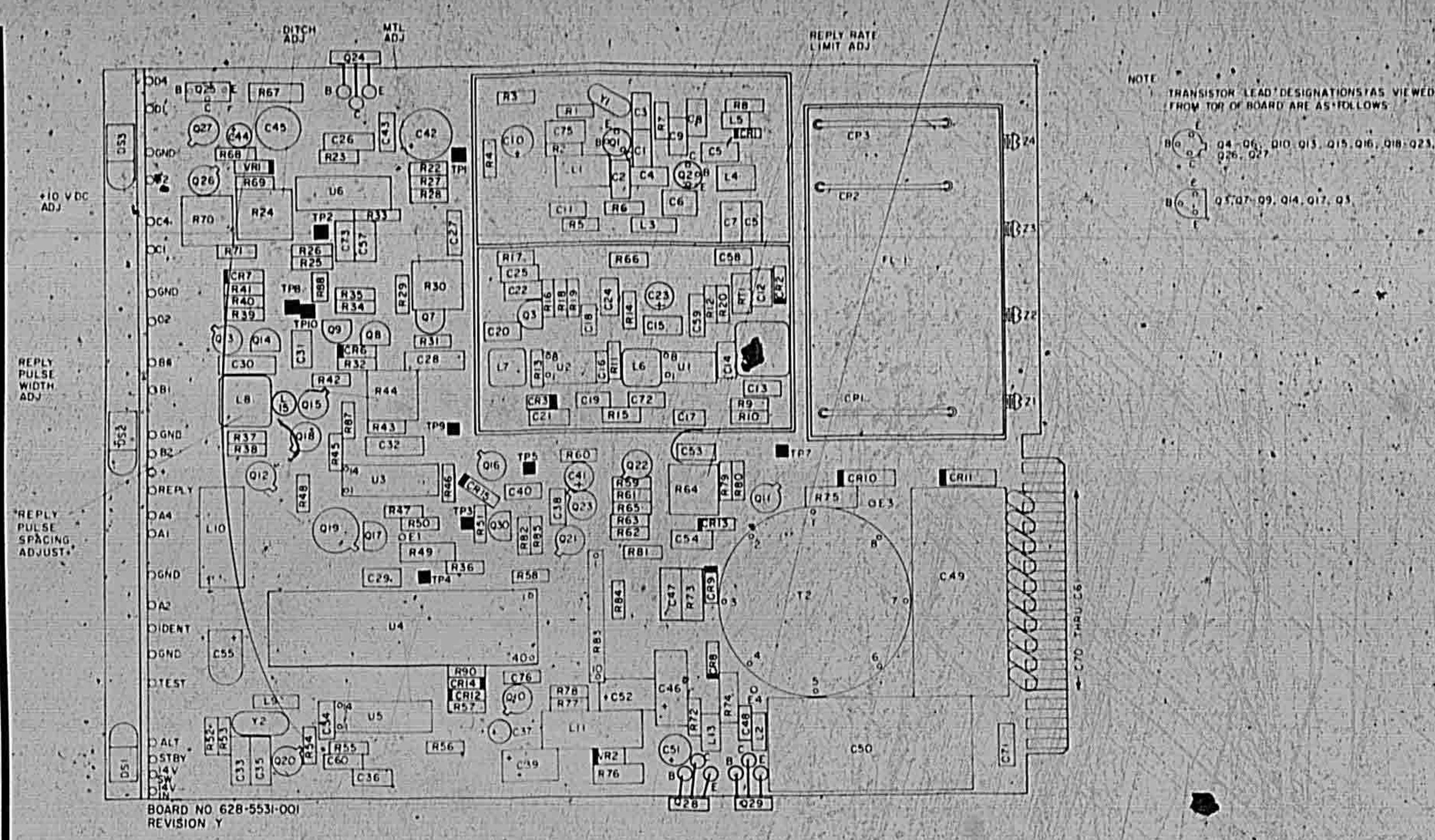
TDR-950/950L Component Location Diagram, REV's V and W, Board No 628-5531-001
Figure 6-3

G

H

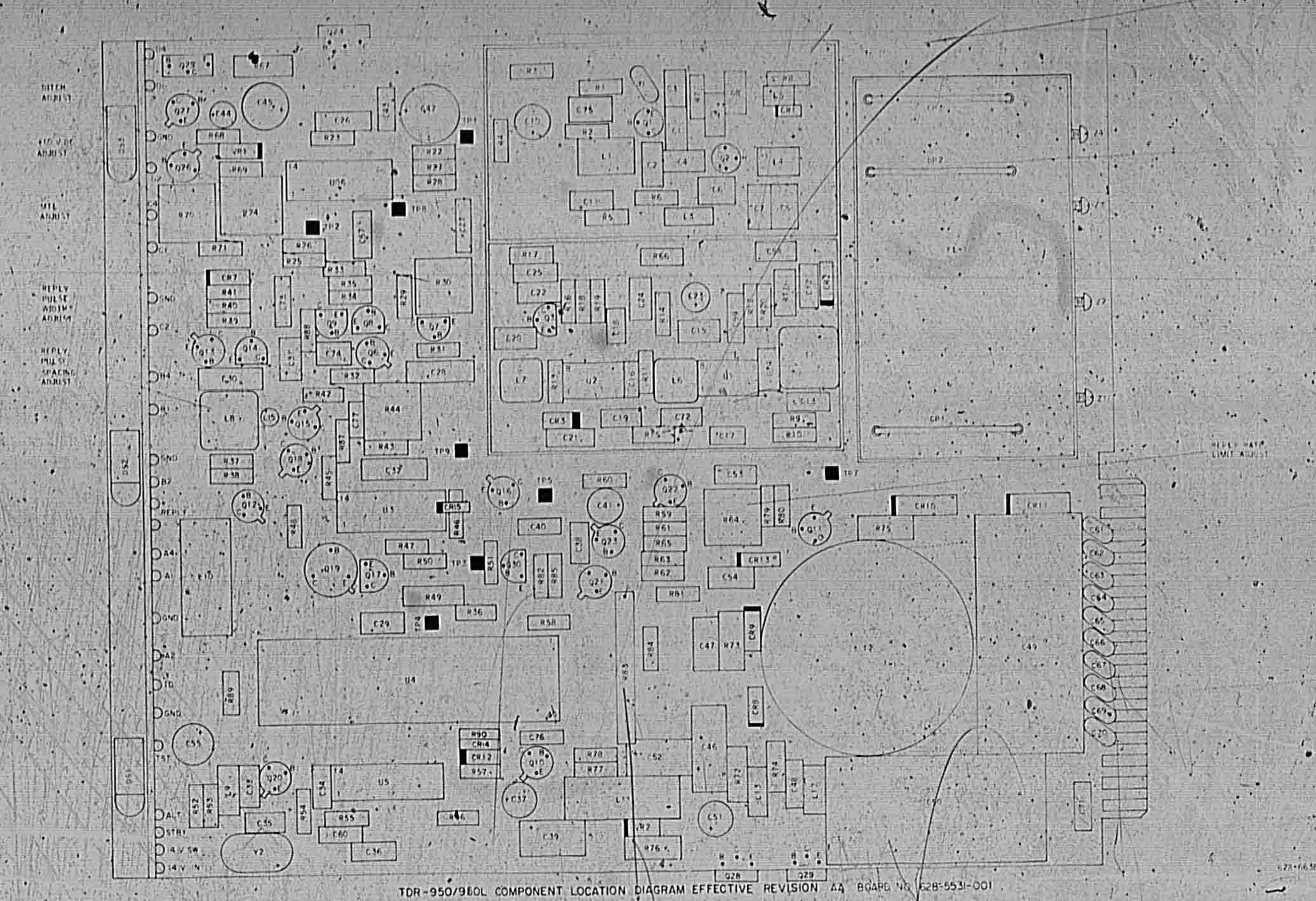


TDR-950/950L Transponder, Schematic Diagram
Figure 6-11



TDR-950/950L Transponder, Component Location Diagram, REV Y, Board No 628-5531-001
Figure 6-4

diagrams 523-0766470



TDR-950/950L Transponder, Component Location Diagram, REV AA, Board No 628-5531-001
Figure 6-5

Revised 2 October 1978

Service Information

ROCKWELL/COLLINS

Micro Line TDR

General Index

TABLE OF BLOW-UPS

SERVICE BULLETINS		PAGE	ATP GRID	BLOW-UP FICHE
TDR 950-8	L15 Location Before Modification	4	1E07	CL K952
TDR 950/L-1	Partial Component Location Diagram Showing Suppression Cirucuitry Fig. 3	6	1E15	
TDR 950/L-2	Hole Locations Fig. 1	5	1E22	
	Electrical Modification Fig. 3	7	1F02	
TDR 950/L-3	Chassis Wiring Fig. 2	6	1F09	
TDR 950/L-5	Before Modification Fig. 2	6	1F21	
	After Modification Fig. 3	7	1F22	
TDR 950/L-7	Before Modification Fig. 1	4	1G11	
	After Modification Fig. 2	5	1G12	
TDR 950/L-9	Electrical Modification Fig. 2	5	1G18	
SERVICE INFO LETTERS				
TDR 950 2-78	After Modification	2	1K03	

CALIFORNIA (415) 468-1705
OUTSIDE CALIFORNIA 800 227-4610

AIRCRAFT TECHNICAL PUBLISHERS
101 SOUTH HILL DRIVE
BRISBANE, CA 94005

CABLE ADDRESS
AIRTECHPUB

INDEX OF: SERVICE BULLETIN   ROCKWELL/COLLINS TDR-950/950L   FULL INDEX   REVISION DATE: 8/17/84

ISSUE NUMBER	DESCRIPTION	GRID LOCATION	ISSUE DATE	COMPLIANCE TIME	PART KIT NUMBER		APPLICABLE AD
TDR 950-8	REPLY PULSE SPACING	1E04/ 1E07	10/16/78	SEE ISSUE	240-2747-320		
TDR 950/L-1 R1	SUPPRESSION CIRCUITRY	1E10/ 1E15	1/02/77	SEE ISSUE	SEE ISSUE		
TDR 950/L-2	L-BAND INTERFERENCE SUPPRESSION	1E18/ 1F02	3/01/76	SEE ISSUE	SEE ISSUE		
TDR 950/L-3 R1	REDUCTION OF L-BAND INTERFERENCE	1F04/ 1F09	4/01/77	SEE ISSUE	SEE ISSUE		
TDR 950/L-4	NEUTRAL LAMP FILTER	1F12/ 1F14	7/15/76	OPTIONAL	262-1296-810		
TDR 950/L-5	REPLY CLOCK TIMING	1F16/ 1F22	2/01/77	SEE ISSUE	242-0434-020	240-2747-320	
TDR 950/L-6 R1	LAMP DS4 RELOCATION	1G02/ 1G06	3/15/77	SEE ISSUE	SEE ISSUE		
TDR 950/L-7	POWER INTERRUPT OSCILLATION IN 28-VOLT SYSTEMS	1G08/ 1G12	5/16/78	SEE ISSUE	SEE ISSUE		
TDR 950/L-9	INCOMING SUPPRESSION	1G14/ 1G18	1/19/79	SEE ISSUE	SEE ISSUE		
TDR-950/-L-10 R1	REPLACEMENT OF MODE SELECTOR	1H03/ 1H06	9/02/83	RECOMMENDED	628-5471-0001	005-0569-000	

INDEX OF: SERVICE INFO LETTERS ROCKWELL/COLLINS TDR-950/950L FULL INDEX REVISION DATE: 6/02/82

ISSUE NUMBER	DESCRIPTION	GRID LOCATION		ISSUE DATE	COMPLIANCE TIME	PART KIT NUMBER		APPLICABLE AD
MICRO LINE 1-75	MICRO LINE TEST EQUIPMENT SPECIFICATIONS	1J04	1J08	10/15/75	SEE ISSUE	SEE ISSUE		
MICRO 2-77 R2	STORAGE AND HANDLING OF ESS COMPONENTS	1J10	1J11	3/01/79	SEE ISSUE	SEE ISSUE		
TDR 950 1-75	TRANSPONDER ANTENNA IDENTIFICATION	1J14		10/01/75	SEE ISSUE	628-6094-001	628-5612-001	
TDR 950 2-75	28- TO 14-V POWER CONVERSION KIT INSTALLATION	1J16		10/15/75	SEE ISSUE	523-0766464		
TDR 950 3-75	INSTALLATION OF NEUTRAL LAMP FILTERS	1J18		12/01/75	SEE ISSUE	262-1296-810		
TDR 950 2-78	F1/F2 PULSE SPACING	1J20		9/26/78	SEE ISSUE	240-2747-320		
TDR 950/L 4-75	DUAL INSTALLATION	1K02	1K05	12/15/75	SEE ISSUE	523-0766464		
TDR 950/L 1-76	SUPPRESSION CIRCUITRY	1K08		12/15/75	SEE ISSUE	SEE ISSUE		
TDR 950/L 2-76	DEFECTIVE SWITCH BOARD ASSEMBLIES	1K10		7/01/76	SEE ISSUE	SEE ISSUE		
TDR 950/L 3-76	ERRONEOUS IDENT ILLUMINATION WHEN TRANSPONDER IS TURNED ON	1K12		7/20/76	SEE ISSUE	184-9113-080		
TDR 950/L 4-76	TRANSMITTER FREQUENCY ADJUSTMENT	1K14	1K16	9/01/76	SEE ISSUE	SEE ISSUE		
TDR 950/L 5-76	TRANSMITTER POWER MEASUREMENT	1K18	1K20	12/01/76	SEE ISSUE	SEE ISSUE		
TDR 950/L 1-77	CAVITY V1 POWER OUTPUT	1K22		3/01/77	SEE ISSUE	SEE ISSUE		
TDR 950/L 2-77	28-VOLT INSTALLATION POWER INTERRUPT	1L02		3/01/77	SEE ISSUE	SEE ISSUE		
TDR 950/L 3-77	IF CIRCUIT ALIGNMENT	1L04		5/01/77	SEE ISSUE	SEE ISSUE		
TDR 950/L 1-78	LOCAL OSCILLATOR ALIGNMENT FOR TRANSPONDERS	1L06		6/23/78	SEE ISSUE	SEE ISSUE		
TDR 950/L 1-79	TRANSMITTER FREQUENCY PULLING DUE TO ANTENNA CONTAMINATION	1L08		4/02/79	SEE ISUE	SEE ISSUE		
MICRO LINE 1-80	28-VOLT INSTALLATION KITS	1L10		5/19/80	SEE ISSUE	SEE ISSUE		
TDR 950/L 2-82	PREFERRED REPLACMENT FOR Q19	1L12		2/18/82	SEE ISSUE	SEE ISSUE		

SERVICE

BULLETINS

Rockwell-Collins | SERVICE BULLETIN
Collins General Aviation Division/Rockwell International

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)

SERVICE BULLETIN NO 8

REPLY PULSE SPACING

1. Planning Information

A. Effectivity

Mandatory on all TDR-950 Transponders with serial numbers between 8100 and 8600.

B. Reason

Encoder clock generator inductor L15 may exhibit inductance variations caused by temperature shock. Depending upon the extent of value change, some units may generate replies that do not meet the 20.3 µs ±0.1 µs pulse spacing specification for framing pulses F1 and F2. Although the transponder will appear to be operating properly in the cockpit (reply lamp will flash when responses are made to valid interrogations), air traffic control plan position indicators may not paint responses because of the erroneous framing pulse period. In this case, pilot reports on units experiencing this problem may include "inoperative unit" or "intermittent operation".

C. Description

(1) Technical

Inductive variations in L15 will cause the decoder clock generator frequency to change. The resulting frequency shift may be sufficient to cause reply pulse spacing to fall outside of equipment specifications.

To correct this problem, inductor L15 is replaced with a component that is not susceptible to temperature shock or inductance variation over the temperature and humidity ranges experienced during normal operating conditions.

(2) Physical

Inductor L15 is replaced with a component of the same value that does not drift with changes in temperature and humidity.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 60 minutes is required to perform the subject modification and test circuit performance.

(2) The time required to test the TDR-950 as a result of this modification will not be affected.

F. Material -- Cost and Availability

The component listed in paragraph 3 is required to modify one TDR-950 Transponder. This part is available for shipment within 30 days after receipt of order at a price of $0.65 (price subject to change without notice). The part may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired component and reference TDR-950 service bulletin 8.

Collins Avionics/Rockwell International will bear the cost for implementation of this service bulletin including 60 minutes labor.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins/Service Information Letters

This service bulletin obsoletes TDR-950 Transponder service information letter 2-78 entitled "F1/F2 Pulse Spacing", dated September 26, 1978. Incorporation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950 Transponder.

(2) Other Publications Affected

The third edition of the TDR-950 Transponder instruction book, Collins part number 523-0766464, will include the changes described in this service bulletin.

J. Test Equipment

No modifications to the specified test equipment is required to test the TDR-950 Transponder as a result of this modification.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the transponder top and bottom covers to provide access to the circuit card.

(2) Locate old inductor L15 and remove (old L15 is located adjacent to L8; refer to partial component location diagram included in this bulletin).

(3) Position new L15 as shown in the partial component location diagram. Wrap one lead of new L15 around the grounded end of R71 and insert the other lead into the hole vacated by old L15. Ensure L15 is located as close as possible to R71 as shown in the illustration.

(4) Replace unit top and bottom covers and perform the test procedures included in paragraph C.

B. Identification Procedure

Use a knife to remove the number 8 on the modification plate and cover the spot with black ink.

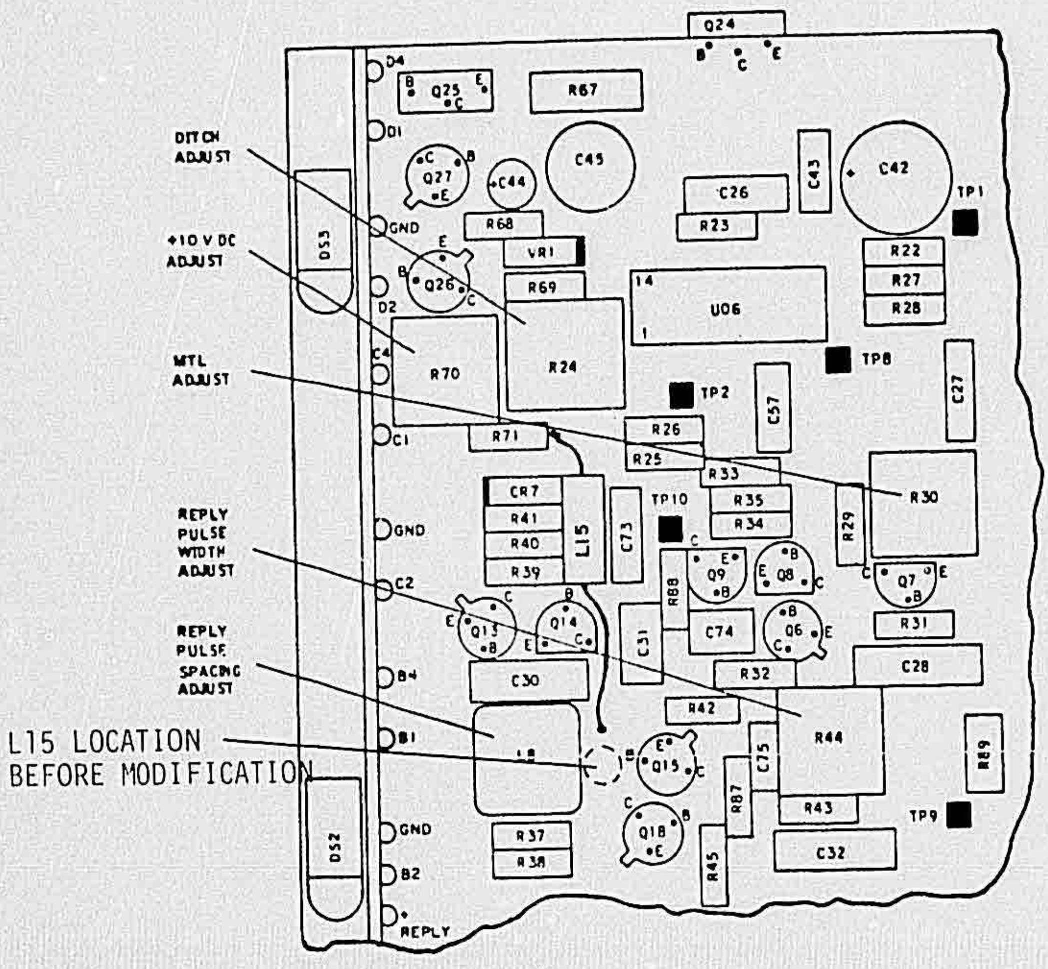
C. Testing Procedure

Refer to the TDR-950 instruction book maintenance section and perform the test procedures of paragraph 5.5.2.9 to ensure the unit is operating properly.

3. Material Information

The component required to modify one TDR-950 Transponder is listed below.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER
240-2747-320	1	$0.65	Inductor, 100 μh	240-2741-060



SEE BLOW-UP

SERVICE BULLETIN

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

REVISION NO 1
TO
SERVICE BULLETIN NO 1

TDR-950/950L SUPPRESSION CIRCUITRY

1. Planning Information

A. Effectivity

This service bulletin is a customer option on all TDR-950/950L Transponders.

B. Reason

In some aircraft transponder installations noticeable interference may exist between the transponder and DME equipment. By adding the incoming and out-going suppression circuitry described in this service bulletin, this form of interference can be eliminated assuming the DME contains suppression circuits that will respond to positive suppression pulses.

C. Description

(1) Technical

This modification adds both incoming and out-going suppression capability to the TDR-950/950L Transponder.

Out-going suppression is generated when a pulse is received at the base of transistor Q11. A 36 microsecond duration suppression pulse is generated and made available at P1-2 for application to other L-band equipment contained in the aircraft. This suppression pulse effectively disables external L-band transmissions until the TDR-950/950L has completed its coded transmission. If another L-band transmitter in the aircraft transmits, it sends a blanking pulse to the incoming suppression circuit consisting of Q10 and associated components. The incoming suppression circuit will disable the encoding process of decoder-encoder U4 for the duration of the blanking pulse thus allowing the external L-band transmitter time to complete its transmission without interference from the TDR-950/950L.

(2) Physical

The circuits shown in figures 1 and 2 are added to existing circuitry.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 60 minutes is required to perform the subject modification and and test circuit performance.

(2) The time required to test the TDR-950/950L as a result of this modification will be increased approximately 20 minutes.

F. Material -- Cost and Availability

The parts listed in paragraph 3 are required to modify one TDR-950/950L Transponder. The parts are available for shipment 30 days after receipt of order at a price of $1.29. (Price subject to change without notice.) The parts may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired component and reference TDR-950/950L Service Bulletin No 1.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Incorporation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950/950L.

(2) Other Publications Affected

The second edition of the TDR-950/950L Transponder Instruction Book, Collins part number 523-0766464, will include the changes covered by this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the transponder top and bottom covers to provide access to the circuit card. Refer to the TDR-950/950L exploded view shown in the maintenance section of the instruction book.

(2) Modify the circuit card assembly as follows:

NOTE: Figure 3 illustrates the physical location of the components to be added by this modification. All circuit board holes are predrilled and located in the correct position. No modifications to the board are necessary.

(a) Refer to figure 3 and insert all 10 components in the positions shown. Ensure Q10, Q11, and CR13 are oriented as shown.

(b) Solder components in place, trim leads, and replace unit top and bottom covers.

B. Testing Procedure

(1) Incoming Suppression

(a) Connect the TDR-950/950L to its test equipment as shown in the maintenance section of the instruction book. Turn the function selector switch to ON and allow 20 seconds for warmup.

(b) Generate a 2-pulse mode A interrogation at 500 interrogations per second. Increase the input power until a 90-percent reply rate is obtained.

(c) Connect an external dc voltage source to P1-2(+) and P1-1(-). Starting at 0 volts increase the voltage at this point until the transponder reply rate is zero. Observe input voltage level. Results: transponder is suppressed when P1-2 voltage is between +5 volts and +50 volts.

NOTE: Transponder should not be suppressed when voltage at P1-2 is less than +0.5 volts.

(2) Out-going Suppression

(a) Connect the TDR-950/950L to its test equipment as shown in the maintenance section of the instruction book. Turn the function selector switch to ON and allow 20 seconds for warmup.

(b) Generate a 2-pulse mode A interrogation at 500 interrogations per second. Increase the input power until a 90-percent reply rate is obtained.

(c) Connect an oscilloscope to P1-2 and observe display. Result: waveform with the following characteristics is observed:

Amplitude: positive pulse; 20 V to 25 V

Duration: 36 μs nominal

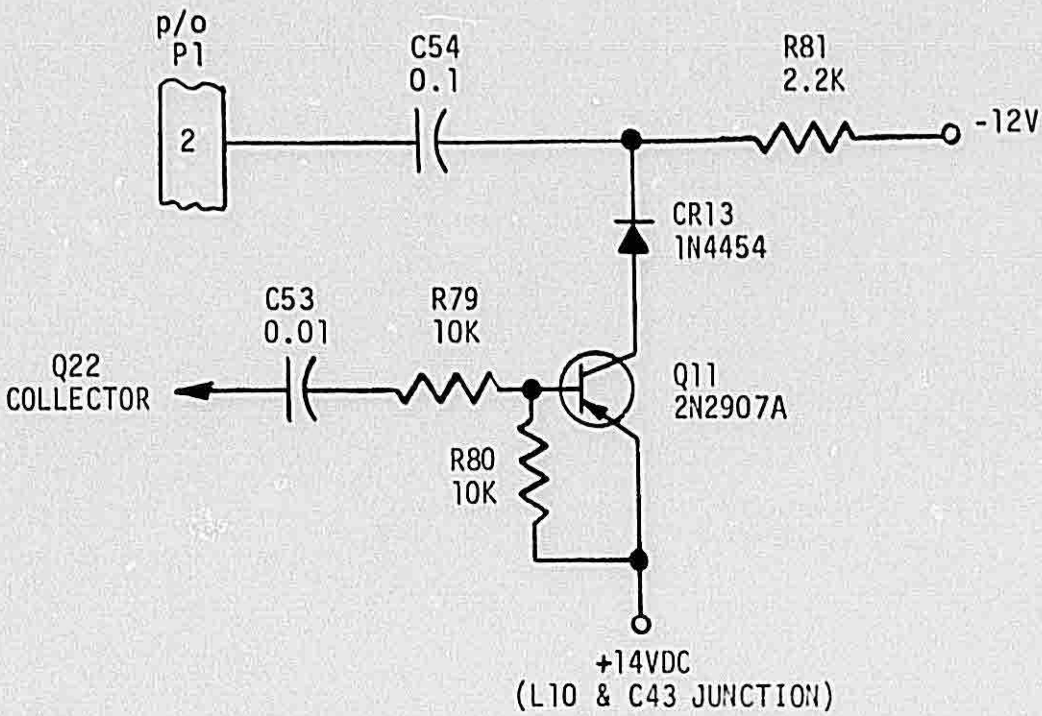
Rise time: less than 1 μs

Fall time: less than 3 μs

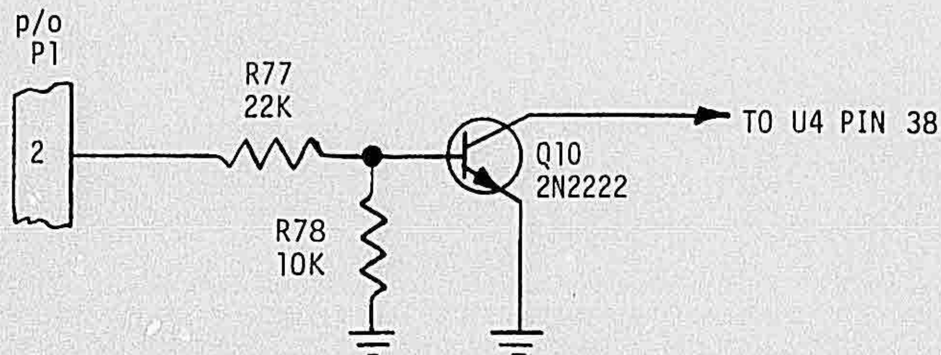
3. Material Information

The parts required to modify one TDR-950/950L are listed below:

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER	INSTRUCTIONS -DISPOSITION
352-5019-010	1	$0.34	Transistor, Q11, 2N2907A	None	None
352-5021-010	1	0.31	Transistor, Q10, 2N2222	None	None
353-3741-010	1	0.06	Diode, 1N4454, CR13	None	None
745-7950-290	1	0.03	Resistor, R81, 2.2 kΩ, 1/4 W, 10%	None	None
745-7950-370	3	0.03	Resistors, R78, R79, R80, 10 kΩ, 1/4 W, 10%	None	None
745-7950-410	1	0.03	Resistor, R77, 22 kΩ, 1/4 W, 10%	None	None
913-3298-130	1	0.06	Capacitor, C53, ceramic, 0.01 μF, 50 V	None	None
913-3306-070	1	0.34	Capacitor, C54, ceramic, 0.1 μF, 50 V	None	None
372-7513-190	1	0.03	Contact	None	None



Out-Going Suppression
Figure 1

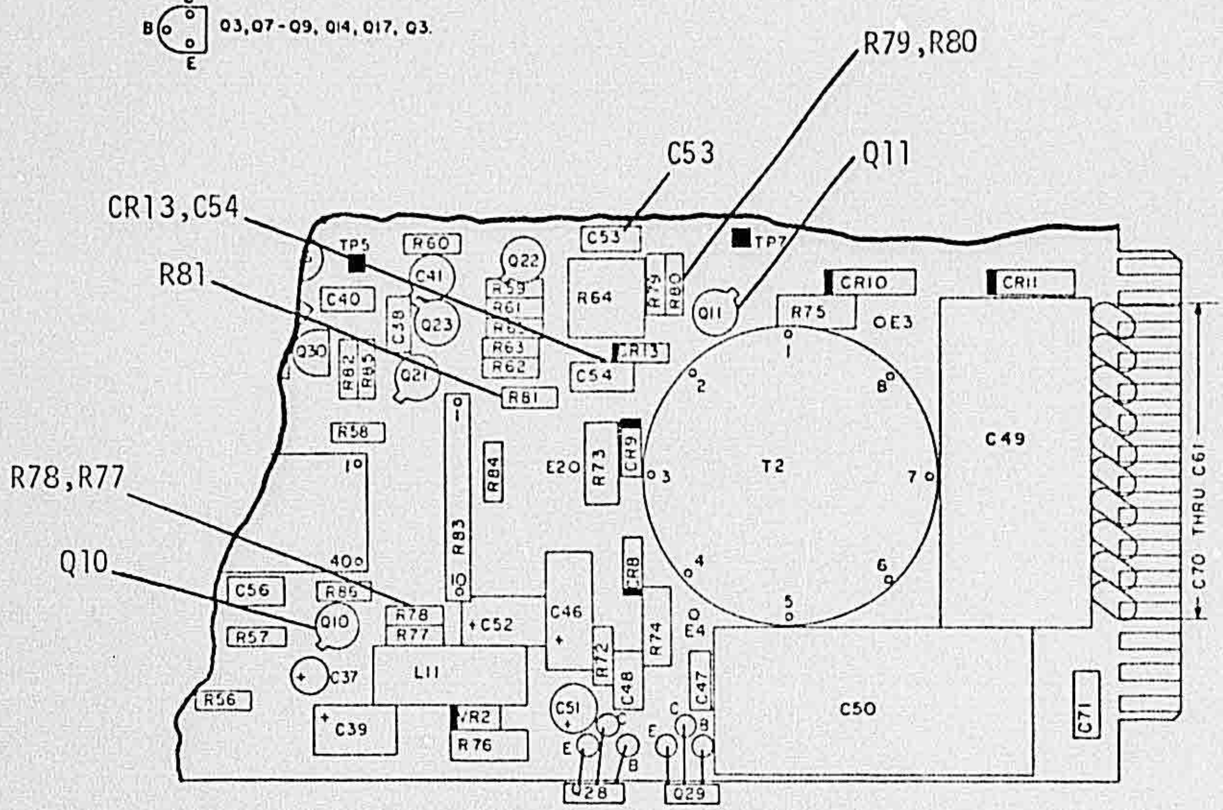


Incoming Suppression
Figure 2

NOTE:
1. TRANSISTOR LEAD DESIGNATIONS AS VIEWED FROM TOP OF BOARD ARE AS FOLLOWS:

Q4-Q6, Q10-Q13, Q15, Q16, Q18-Q23, Q26, Q27.

Q3, Q7-Q9, Q14, Q17, Q3.



Partial Component Location Diagram of TDR-950/950L
Showing Suppression Circuitry
Figure 3

SEE BLOW-UP

SERVICE BULLETIN

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE BULLETIN NO 2

TDR-950/950L L-BAND INTERFERENCE SUPPRESSION

1. Planning Information

A. Effectivity

This service bulletin is a customer option on all TDR-950/950L Transponders below serial number 1778.

B. Reason

In some aircraft installations L-band interference generated by the transponder may be observed as an audible noise or tone outburst in the automatic direction finder system.

C. Description

(1) Technical

This modication suppresses the L-band interference generated by the TDR-950/950L. Both physical and electrical changes must be made to arrive at the reduced interference level. Ferrite beads, characteristically inductive, are added to the plate and filament wires connected to transmitter tube V1 and the cathode wire is replaced with shielded wire also using ferrite beads near the termination point. These beads attenuate the spurious L-band interference generated by the cavity. In addition to the ferrite beads, both top and bottom covers are secured to the chassis at the rear of the unit. This improves chassis ground continuity thereby reducing interference.

(2) Physical

The cathode lead is replaced with shielded wire and groups of three ferrite beads are added to the plate, filament, and cathode wires near the transmitter cavity. The unit top and bottom covers are secured to the chassis at the rear by adding three angle nuts, lockwashers, and screws. To provide clearance for the top cover attaching hardware, a small notch must be made in the printed circuit board.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 60 minutes is required to perform the subject modification and test circuit performance.

(2) The time required to test the TDR-950/950L as a result of this modification will not be affected.

F. Material -- Cost and Availability

The parts required to modify one TDR-950/950L Transponder are listed in paragraph 3. The parts are available for shipment 30 days after receipt of order at a price of $0.33. (Price subject to change without notice). The parts may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired component and reference TDR-950/950L Service Bulletin No 2.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Incorporation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950/950L.

(2) Other Publications Affected

The second edition of the TDR-950/950L Instruction Book, Collins part number 523-0766464, will include the changes covered by this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the transponder top and bottom covers. Refer to figure 1 and drill three 0.093 inch diameter holes in the locations shown (two holes in bottom cover, one hole in top cover).

(2) Remove any burrs that may have resulted from drilling and insert one angle nut in each hole. Using a rivet rolling tool or center punch and hammer, flare the rivet shaft. Angle nut must be securely attached to cover in each of the three positions.

NOTE: Figure 2 is an exploded view of the chassis and cover rear assembly. Refer to this drawing to ensure correct modification installation and assembly.

(3) Refer to figure 1 and drill three 0.120 inch diameter holes in the rear of the chassis. These holes are located extremely close to the chassis edge. To prevent drill slippage center punch each hole before drilling. Remove all burrs from chassis.

(4) Refer to figure 1 and locate the area notch is to be placed. Using a scribe or sharp pointed tool, mark off the area to be removed. Then using a pattern file, cut the notch to the required dimensions.

NOTE: Figure 3 illustrates the electrical changes described in the following steps.

(5) Using a razor blade or X-acto knife, remove the Silastic insulating material at the plate of the tube. Unsolder the plate wire (red) at the tube and slip three large ferrite beads over the end. Resolder the plate wire and slide the ferrite beads as close to the cavity as possible. Apply a generous amount of Silastic around the plate terminal area and beads after solder has cooled.

(6) Unsolder filament wire (brown) from opposite end of tube. Slip three small ferrite beads over the end of the filament wire and resolder to tube. Apply Silastic or lacing tape (style 18) to secure beads.

(7) Locate cathode wire (yellow), remove, and discard. Cut a piece of #22 AWG shielded wire approximately the same length and strip each end back 3/4 inch. Solder center conductor to point E1 on circuit board. Position shield on ground plane between resistors R49 and R50 and solder in place; trim as required.

(8) Slide three ferrite beads over center conductor of shielded wire at the tube end and solder to cathode terminal. Solder shield to tube ground terminal.

(9) Replace top and bottom covers using the screws removed earlier. In addition to these, add the three #4-40 PPH screws and lockwashers included in the modification kit as shown in figure 2.

(10) Perform the test procedures detailed in step B.

B. Testing Procedure

Perform paragraph 5.5.2.9 of the minimum performance test procedure contained in the maintenance section of the TDR-950/950L Transponder Instruction Book to ensure the unit is operating normally.

As a ramp test, apply power to both the TDR-950/950L and the ADF allowing several seconds for warmup and stabilization. Select code 4421 on the TDR-950/950L and set the ADF for reception at 240 kHz. This code/frequency combination is a point of maximum interference. The absence of audible interference indicates the TDR-950/950L is operating properly.

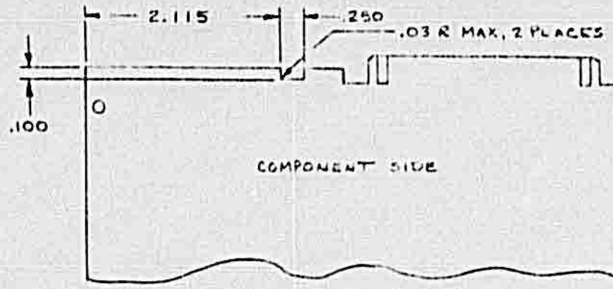
C. Identification Procedure

Use a knife to remove the number 2 on the modification plate, and cover the spot with black epoxy ink.

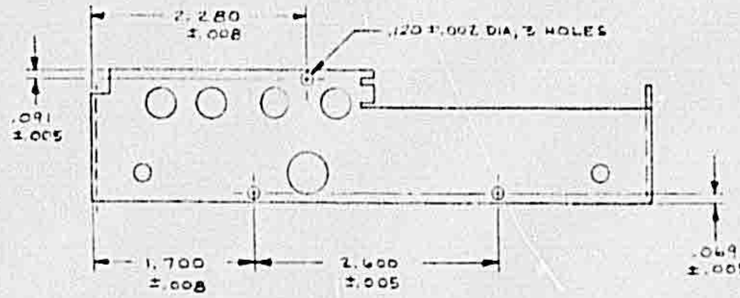
3. Material Information

The parts required to modify one TDR-950/950L are listed below:

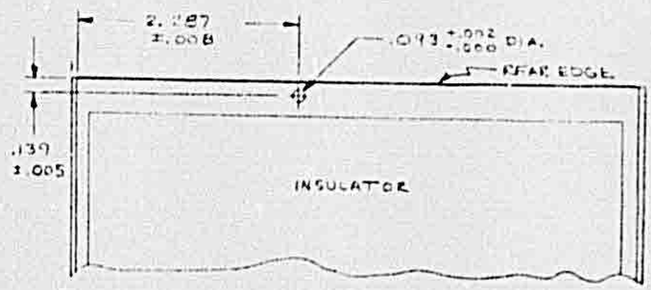
NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER	INSTRUCTIONS - DISPOSITION
504-7698-002	3	$0.23	Angle nut		
288-1325-010	3	$0.03	Ferrite bead (large)		
288-1337-020	6	$0.03	Ferrite bead (small)		
310-0279-000	3	$0.01	Lockwasher, No 4		
343-0133-000	3	$0.03	Screw, #4-40 PPH		
Installer supplied			Wire, #22 AWG shielded, approx 8 in		
Installer supplied			Silastic 140		



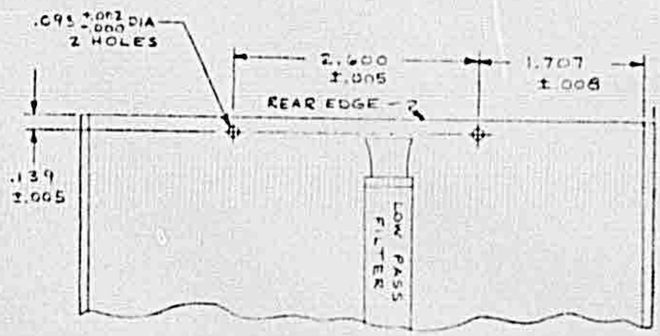
CIRCUIT BOARD MOD



CHASSIS MOD



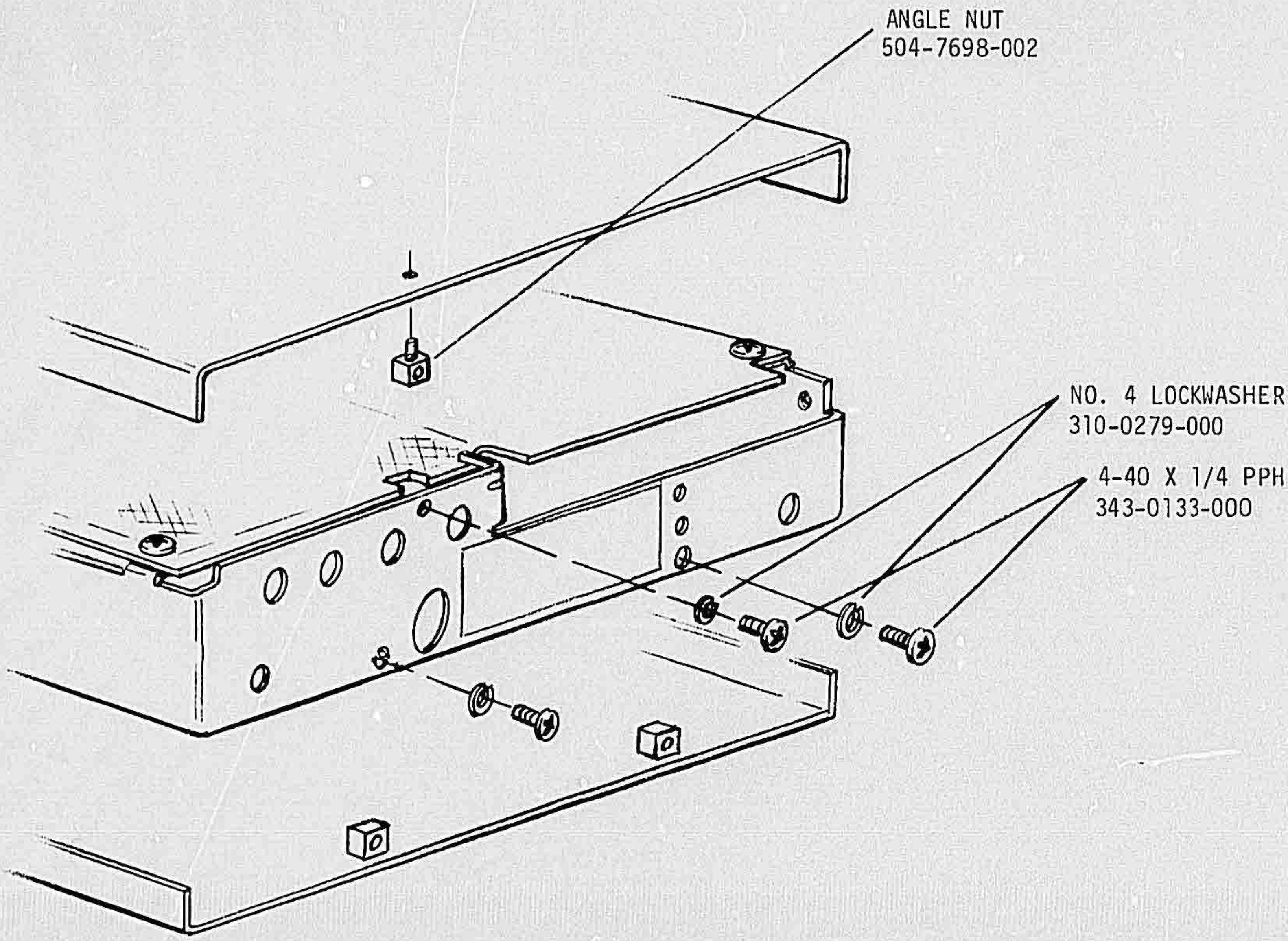
TOP COVER MOD



BOTTOM COVER MOD

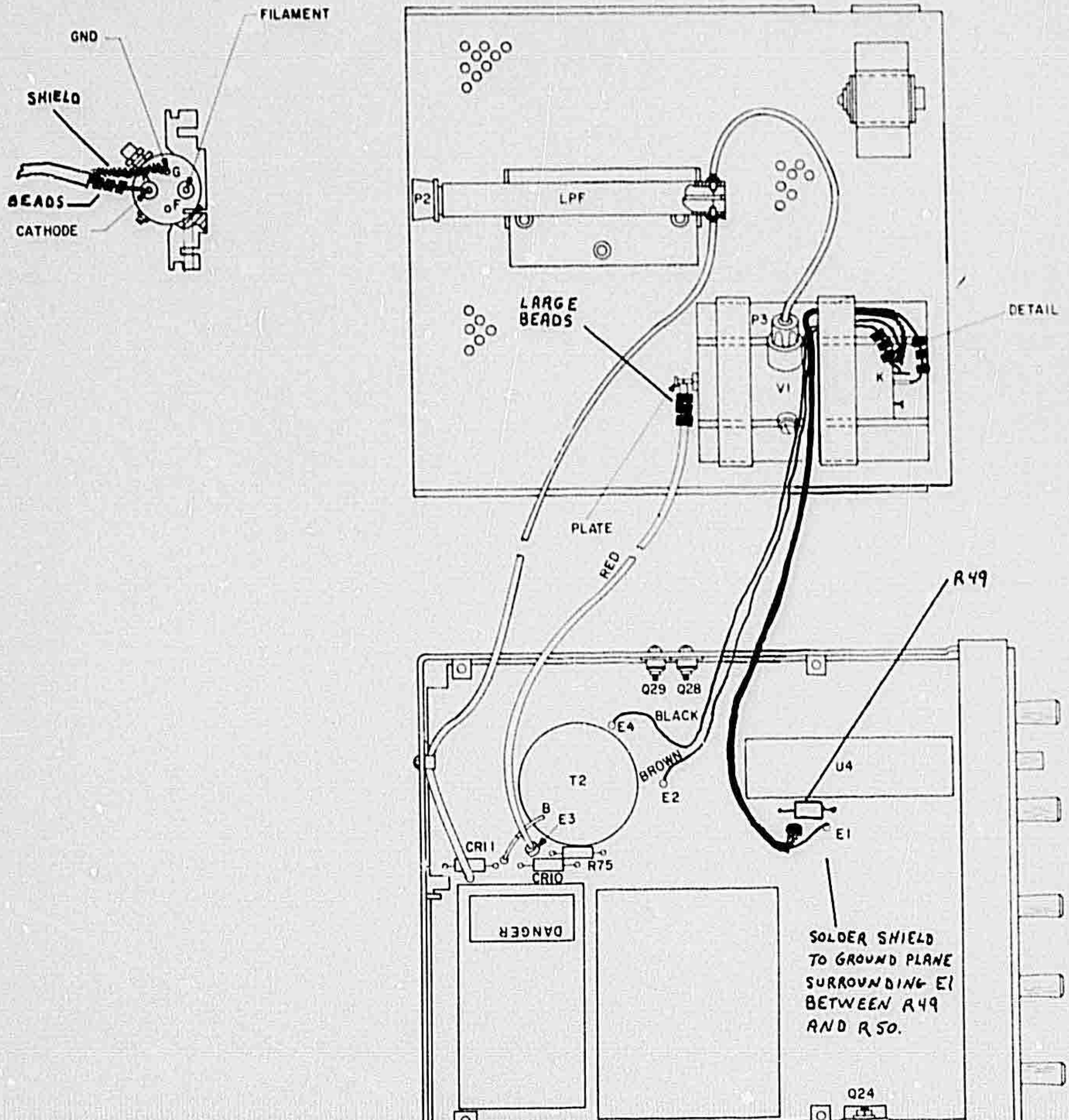
Hole Locations
Figure 1

SEE BLOW-UP



Mechanical Modifications
Figure 2

SERVICE BULLETIN



Electrical Modifications
Figure 3

SEE BLOW-UP

Collins
Collins Radio Group
Rockwell International

SERVICE BULLETIN

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
AND
TDR-950L TRANSPONDER (622-3004-001 THROUGH-006)

REVISION NO. 1
TO
SERVICE BULLETIN NO. 3

REDUCTION OF L-BAND INTERFERENCE

1. Planning Information

A. Effectivity

Production incorporation of service bulletin 3 began with the following serial numbers: TDR-950 3900 and TDR-950L 1400. Installation of service bulletin 3 is optional in all transponders with serial numbers below those listed.

B. Reason

In some aircraft installations L-band interference remains a problem even though service bulletin no 2 has been incorporated. This service bulletin describes an additional modification that, when combined with service bulletin no 2, greatly reduces the generation of L-band noise. This modification should be incorporated only when a conventional installation exhibits transponder L-band interference.

C. Description

(1) Technical

This modification further reduces the L-band interference generated by the TDR-950/950L. Reduction of the spurious L-band noise is accomplished by replacing the cavity plate and cathode leads with coax/shielded wire physically tuned to yield minimum impedance thereby maximizing the attenuating effect of the ferrite beads at the unwanted frequency.

(2) Physical

The cavity plate lead is replaced with a 231 mm (9.1 in) length of RG-316 coax, the shield of which is grounded at the tube using a solder lug. All ferrite beads are replaced at the tube end, and the board end is tacked in place using Silastic to provide strain relief and electrical insulation.

The cathode lead is also replaced, however a 231 mm (9.1 in) length of #22 AWG shielded wire is used. The shield is grounded at the tube end and all ferrite beads are replaced. The board end is left ungrounded and held in place using Silastic for strain relief.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 30 minutes is required to perform the subject modification and test circuit performance.

(2) The time required to test the TDR-950/950L as a result of this modification will not be affected.

F. Material -- Cost and Availability

The parts required to modify one TDR-950/950L Transponder are listed in paragraph 3. The parts are available for shipment within 30 days after receipt of order at a price of $0.20 (price subject to change without notice). The parts may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired component and reference TDR-950/950L Service Bulletin No 3.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Transponders below serial number 1778 generating L-band interference should first be checked to ensure service bulletin number 2 has been installed. If service bulletin number 2 has not been installed substitute the applicable portions of service bulletin number 3 into service bulletin number 2 prior to modification. Carefully read each bulletin before attempting modification.

(2) Other Publications Affected

The third edition of the TDR-950/950L Instruction Book, Collins part number 523-0766464, will include the changes covered by this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the transponder top and bottom covers.

(2) Using a razor blade or X-acto knife, remove the Silastic insulating material at the plate of the tube. Unsolder the plate wire (red) at both ends and discard; save three ferrite beads.

(3) Prepare a length of RG-316 as shown in figure 1 and solder braid to lug. Slide the three ferrite beads saved in step (2) over the center insulator and solder the center conductor to the plate terminal. Attach solder lug to tube cradle using lockwasher and screw as shown in detail A of figure 2.

(4) Solder opposite end of plate lead to board at hole E3. Do not replace ferrite bead at this end.

(5) Unsolder and discard cathode lead; save all ferrite beads.

(6) Prepare a length of #22 AWG shielded wire as shown in figure 1. Slide the three ferrite beads saved in step (5) over the center insulator at the pigtail end and solder the center conductor to the cathode terminal. Solder the shield pigtail to the tube ground terminal.

(7) Solder opposite end of cathode lead to hole E1. Do not ground shield at this end.

(8) After all wires have been soldered in place, apply a liberal amount of Silastic compound at E1, E3, and the tube plate terminal to provide strain relief and electrical insulation.

(9) Replace unit top and bottom covers and perform the test procedures detailed in step B.

B. Testing Procedure

Perform paragraph 5.5.2.9 of the minimum performance test procedure contained in the maintenance section of the TDR-950/950L Transponder Instruction Book to ensure the unit is operating normally.

As a ramp test, apply power to both the TDR-950/950L and the ADF allowing several seconds for warmup and stabilization. Select code 4421 on the TDR-950/950L and set the ADF for operation at 240 kHz. This code/frequency combination is a point of maximum interference. The absence of audible interference indicates the TDR-950/950L is operating properly.

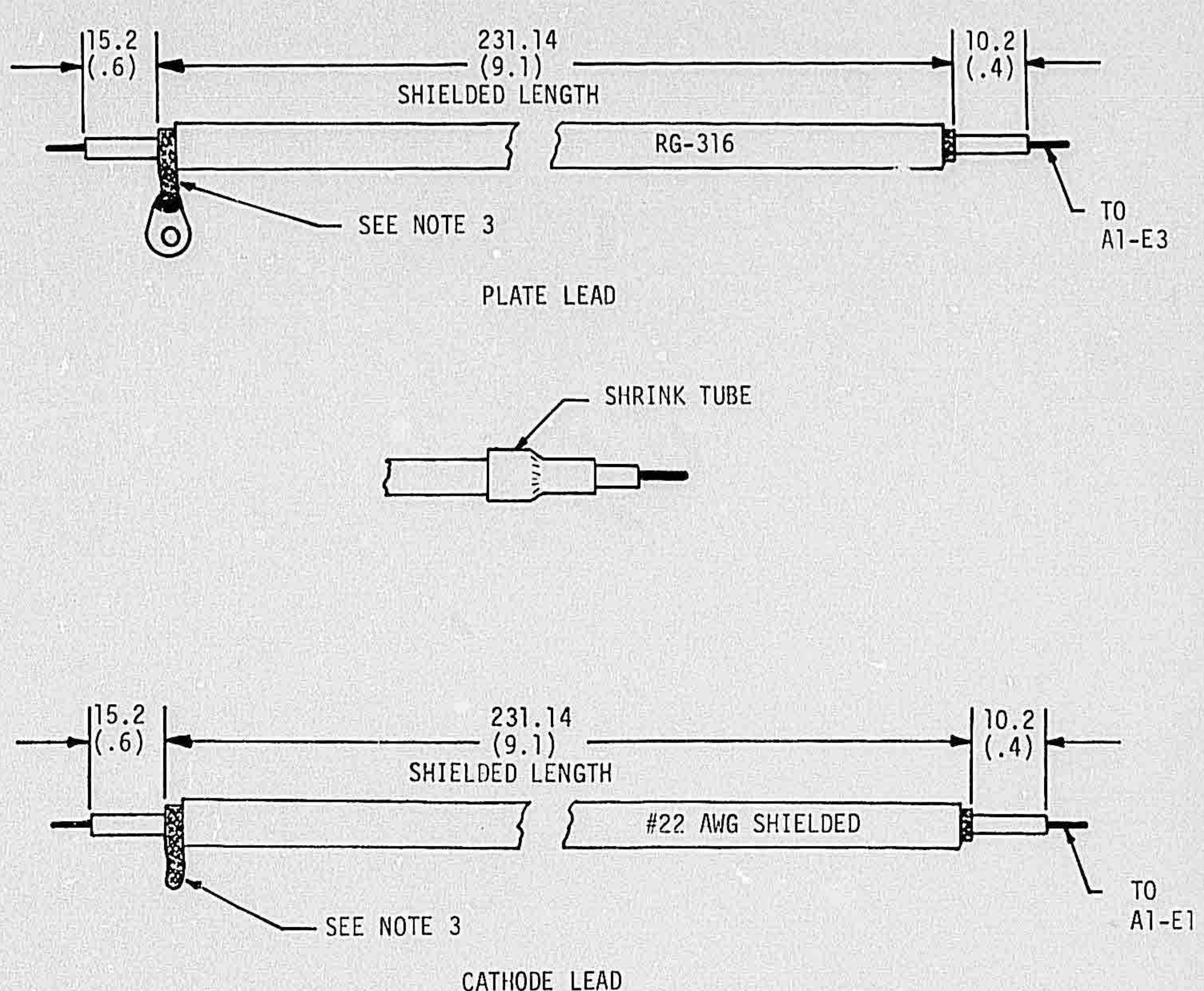
C. Identification Procedure

Use a knife to remove the number 3 on the modification plate, and cover the spot with black epoxy ink.

3. Material Information

The parts required to modify one TDR-950/950L are listed in the following tabulation:

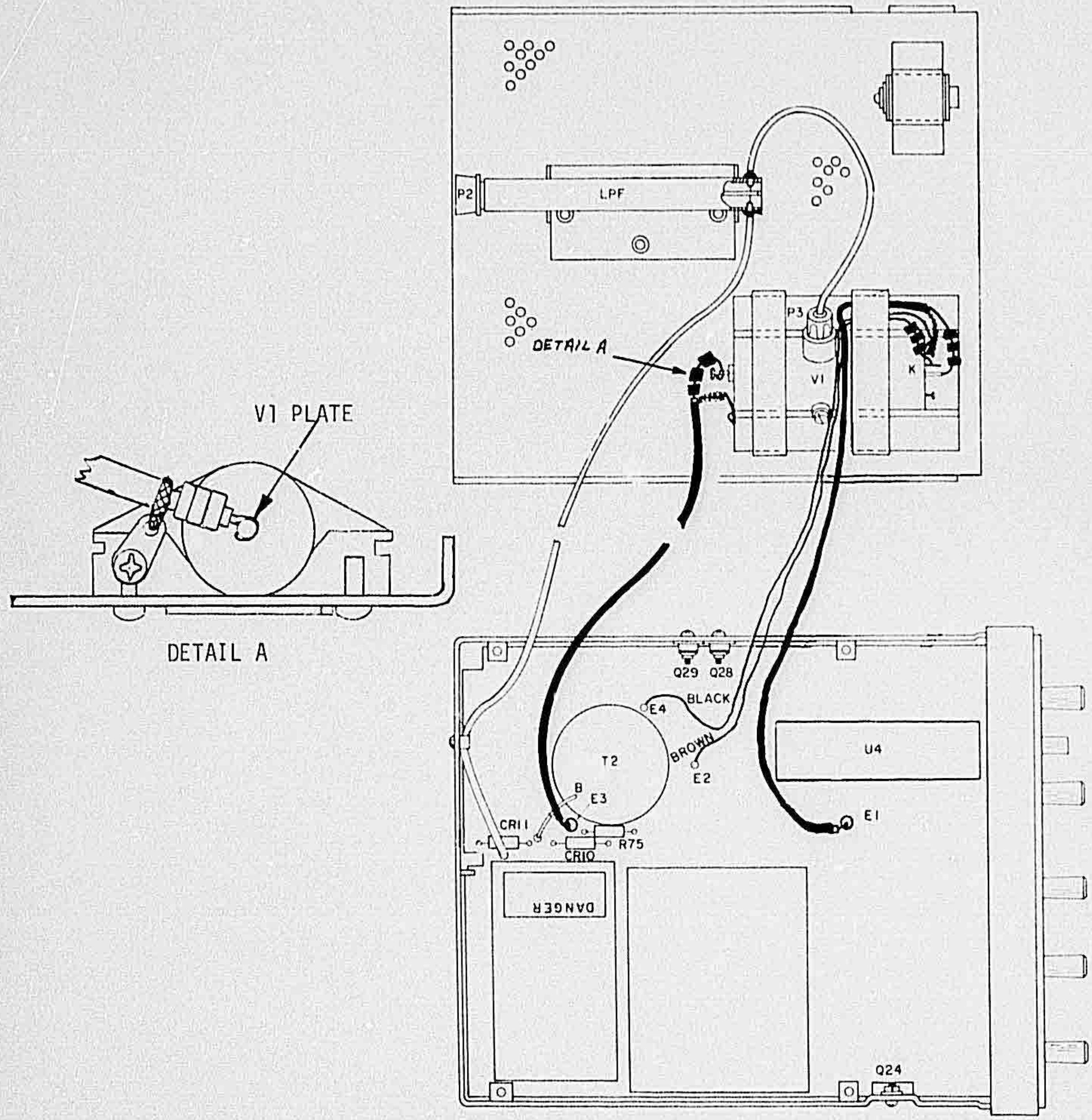
NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER	INSTRUCTIONS -DISPOSITION
330-1779-040	1	$0.14	Screw, 4-40 x 1/4 PPH		
304-0015-000	1	0.03	Solder lug		
373-0006-000	1	0.03	Washer, lock no. 4		
439-0597-040			Wire, #22 AWG shielded, approximately 305 mm (12 in.)		
425-0222-040			Coax, RG-316, approximately 305 mm (12 in.)		
Installer supplied			Silastic		



NOTES:

1. DIMENSIONS ARE IN MILLIMETERS (INCHES).
2. DIMENSIONS ARE ±2.54 MM (±0.1 INCH).
3. MAKE SHIELD PIGTAIL AS SHORT AS POSSIBLE.

Type and Wire Length
Figure 1



Chassis Wiring
Figure 2

SEE BLOW-UP

SERVICE BULLETIN

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
AND
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE BULLETIN NO 4

NEUTRAL LAMP FILTERS

1. Planning Information

A. Effectivity

Optional on all TDR-950/950L Transponders.

B. Reason

The TDR-950/950L is factory equipped with a blue-white back-lit display to provide maximum visibility during night or low-light level operations. These standard filters however, may not match or satisfy the lighting preferences of some TDR-950/950L owners. For this reason a neutral lamp filter installation is described in this service bulletin.

C. Description

(1) Technical

This modification does not affect the electrical characteristics or performance of the TDR-950/950L. The only physical difference perceived will be the color of the back-lit display.

(2) Physical

The unit front panel is removed and the blue-white filters are replaced with neutral filters; lamp replacement is not required.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An extimated 20 minutes is required to perform the subject modification and test the affected area.

(2) The time required to test the TDR-950/950L as a result of this modification will not be affected.

F. Material -- Cost and Availability

The parts listed in paragraph 3 are required to modify one TDR-950/950L Transponder. The parts are available for shipment within 30 days after receipt of order at a price of $0.50 each (price subject to change without notice; minimum order charge $25.00). The filters may be obtained from Collins Radio Group/ Rockwell International, Service Parts Department, Cedar Rapids, Iowa 52406. All orders should specify the Collins part number of the desired component and reference TDR-950/950L Service Bulletin No 4.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Incorporation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950/950L.

(2) Other Publications Affected

The third edition of the TDR-950/950L Transponder Instruction Book Bulletins Section, Collins part number 523-0766471, will include this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the front panel assembly by removing four screws (two on each side) and separating the front panel from the unit chassis.

NOTE: Ensure none of the five wafer switches are rotated while the unit is disassembled.

(2) Remove the three blue filters and replace with neutral filters.

CAUTION: DO NOT FORCE FRONT PANEL ASSEMBLY BACK INTO PLACE. IF DIFFICULTY IS EXPERIENCED CHECK WAFER SWITCH KEYING SLOTS WITH KNOB SHAFT KEYING SLOTS FOR PROPER ALIGNMENT. IDENT BUTTON MUST ALSO BE SEATED PROPERLY TO FACILITATE REPLACEMENT.

(3) Replace front panel assembly and secure in place using screws removed in step (1).

B. Testing Procedure

Apply +13.75 V dc to P1 pin 13 and ground P1 pin 1. Observe panel lighting. Results: Lighting should be even and leak free.

C. Identification Procedure

Use a knife to remove the number 4 on the modification plate and cover the spot with black epoxy ink.

3. Material Information

The parts required to modify one TDR-950/950L are listed below.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER	INSTRUCTIONS -DISPOSITION
262-1296-810	3	$0.50	Lamp filter, neutral	152-2783-000	Discard

Collins
Collins Radio Group
Rockwell International

SERVICE BULLETIN

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)

&

TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE BULLETIN NO. 5

REPLY CLOCK TIMING

1. Planning Information

A. Effectivity

Transponders that require modification are listed in the following table. Note that there are exceptions to the cut-in serial numbers supplied. The only means of identifying an exception is by visual inspection of the subject inductor. If TOKO is stamped on the top of the inductor, this service bulletin need not be installed.

UNIT	SERIAL NUMBER	EXCEPTIONS
TDR-950	3856 and above	Above 3855: those units that have TOKO stamped on top of L8 (or no. 5 darkened on modification plate).
TDR-950L	1566 and above	Above 1565: those units that have TOKO stamped on top of L8 (or no. 5 darkened on modification plate).

In addition to those units listed above, this service bulletin must also be installed whenever a TOKO inductor fails in a transponder that does not contain this service bulletin.

B. Reason

A change in inductor L8 vendors has resulted in inductance variation as a function of temperature and humidity. This variation in inductance may result in reply pulse spacing being outside the limits of the national standard.

C. Description

(1) Technical

This modification changes the value of variable inductor L8, and adds a fixed value inductor in series with it. Fixed value inductor L15 minimizes unwanted inductance variation in L8 and maintains reply pulse spacing limits well within specification.

(2) Physical

Inductor L8 is removed and replaced with a 43 µh variable coil, and fixed inductor L15 is added. A single hole must be located and drilled to facilitate installation of L15.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 90 minutes is required to perform the subject modification and test the affected circuit.

(2) The time required to test the TDR-950/950L as a result of this modification will not be affected.

F. Material -- Cost and Availibility

The parts required to modify one TDR-950/950L Transponder are listed in paragraph 3. The parts are available for shipment within 30 days after receipt of order at a price of $2.33 (price subject to change without notice). The parts may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired component and reference service bulletin number 5.

Collins Avionics - Rockwell International will bear the cost for implementation of this service bulletin, including 90 minutes labor, for 90 days after the publication date of this document. This is in effect for those units under warranty per existing Avionics Warranty Claim Policy Dealer Letter No. 142.

G. Tooling -- Price and Availibility

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Incorporation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950/950L.

(2) Other Publications

The third edition of the TDR-950/950L Transponder Instruction Book, Collins part number 523-0766464, will include the changes described in this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

NOTE: Check to ensure the number 5 has not been darkened on the modification plate before installing this bulletin.

(1) Remove the transponder top and bottom covers to provide access to the circuit board.

NOTE: Figure 1 shows the location of the hole that must be added to the circuit board for installation of L15. Figures 2 and 3 show the before and after modification effects of this bulletin.

(2) With the bottom cover folded back and the transponder facing you, locate variable inductor L8.

IMPORTANT: Before continuing, check to see if L8 has TOKO stamped on top of the can. If TOKO is present do not perform this modification; if TOKO is not plainly visible, continue with step (3).

(3) Remove and discard old L8.

(4) Refer to figure 1 and locate the new hole to be added for L15 mounting. After locating, drill a 0.063 inch diameter hole and deburr.

(5) Again referring to figure 1, enlarge the indicated existing hole to 0.063 inch diameter and remove the copper around this hole to form a 0.130 inch copper-free O.D. around the enlarged hole.

(6) Return to the component side of the board and install new L8. Solder in place all terminals except the one from which copper was removed in step (5).

(7) Slide a 5 mm (0.2 in.) length of sleeving (sleeving should be snug around component lead) over one lead of new L15, and insert this sleeved lead through the new hole drilled in step (4). Ensure that sleeving is pushed up against L15 body and that sleeving protrudes through new mounting hole. Bend this lead for attachment to the L8 terminal at point where copper was removed from board. Solder L15 to L8 and check for shorts to other runs.

(8) Solder the remaining lead of L15 to the top of L8 can. Lead sleeving is not necessary.

(9) Replace transponder top and bottom covers, and perform the test procedures described in step B.

B. Testing Procedure

Perform the reply parameter test procedure of paragraph 5.5.2.10 contained in the detailed test and alignment procedures portion of the instruction book maintenance section.

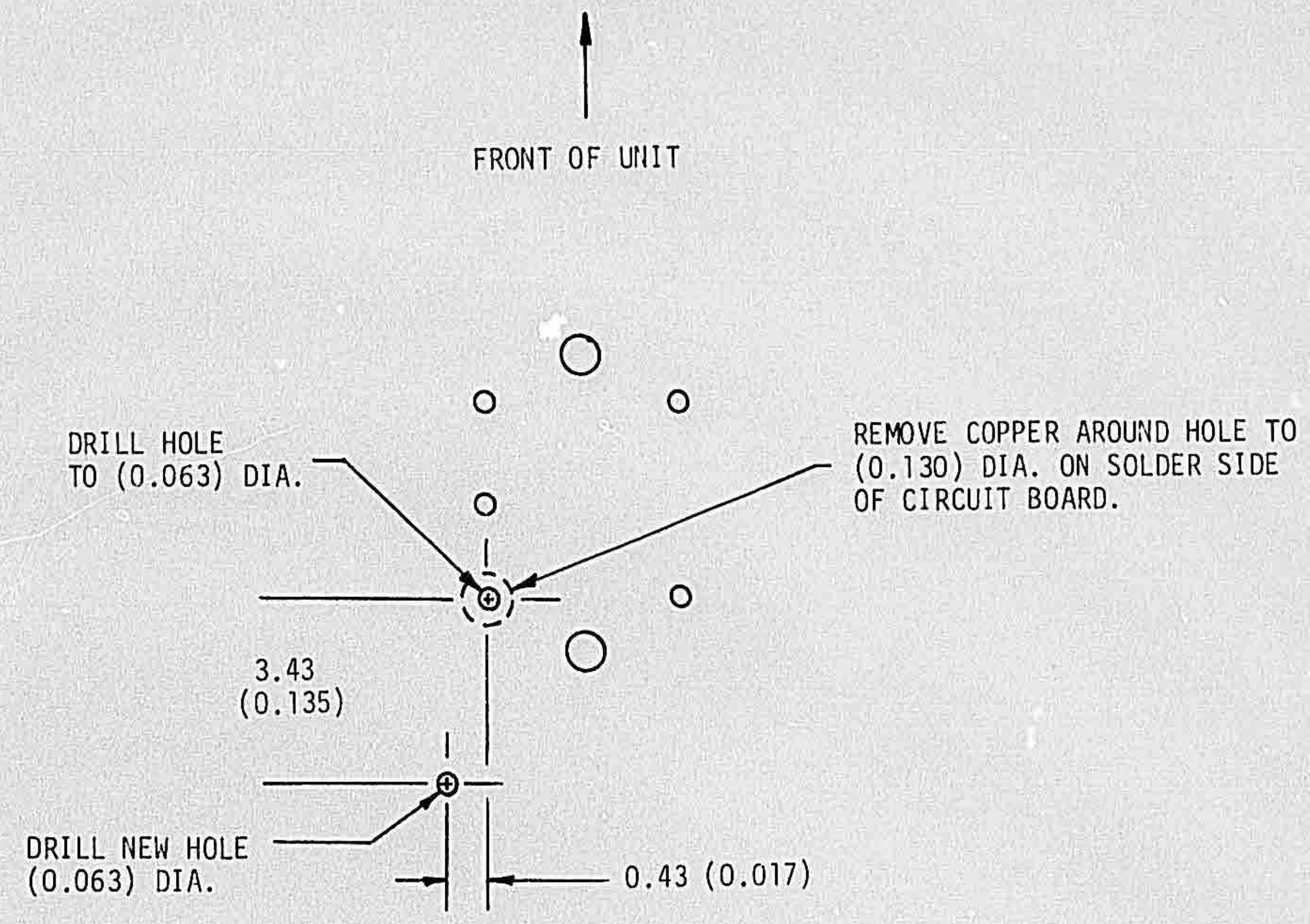
C. Identification Procedure

Use a knife to remove the number 5 on the modification plate, and cover the spot with black epoxy ink.

3. Material Information

The parts required to modify one TDR-950/950L Transponder are listed in the following tabulation.

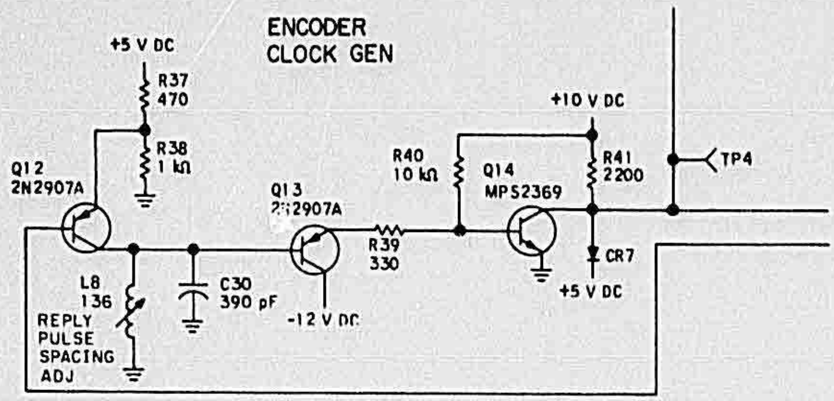
NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACES COLLINS PART NUMBER
242-0434-020	1	\$1.78	L8, coil, variable, 43 μh	242-0434-010
240-2747-320	1	\$0.55	L15, coil, fxd, 100 μh	-
Installer supplied	5 mm	-	Sleeving	-

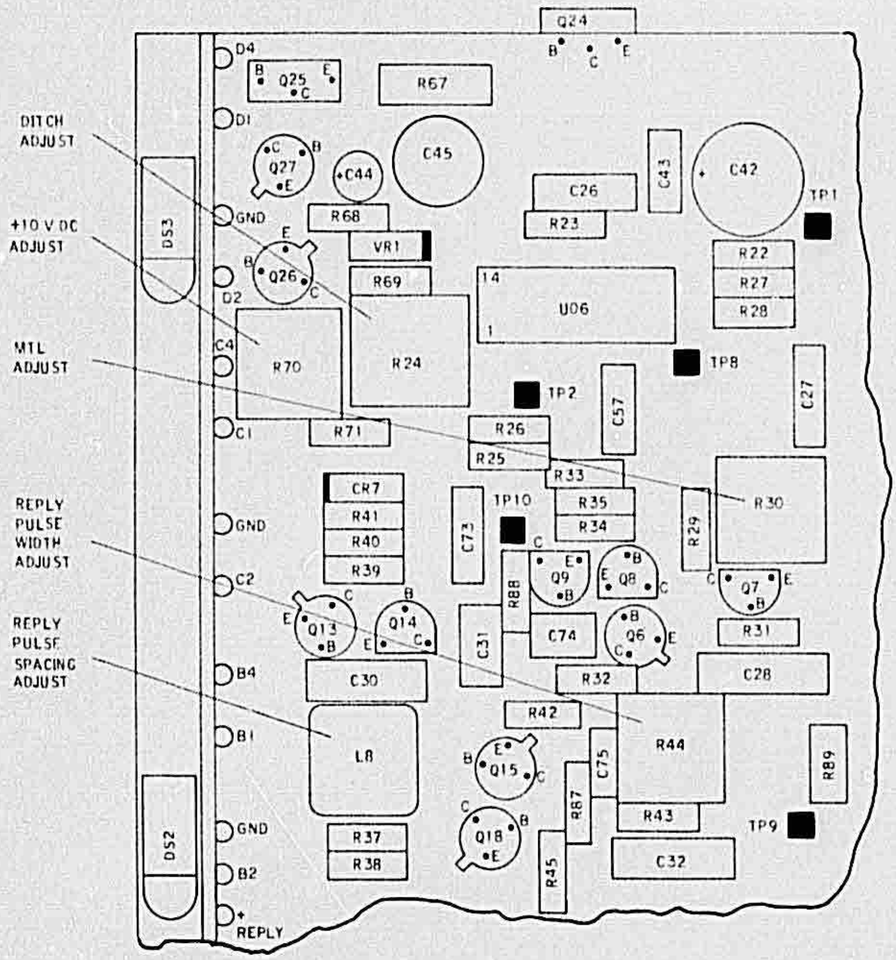


NOTE: DIMENSIONS ARE IN
mm (in.).

Inductor L8 Mounting Holes
As Viewed From
Solder Side of Board

Figure 1



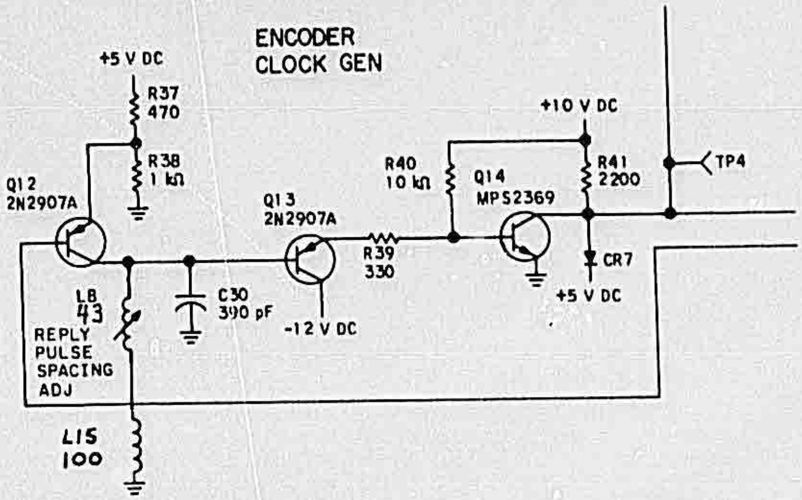


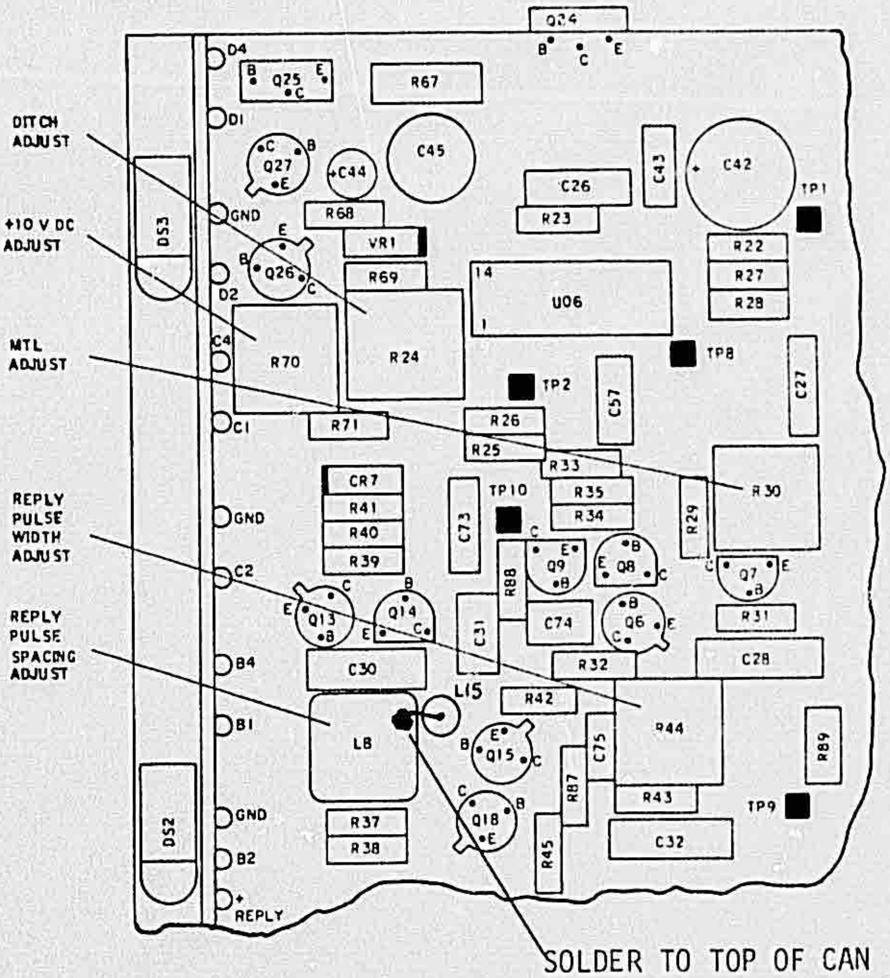
Before Modification

Figure 2

SEE BLOW-UP

SERVICE BULLETIN





After Modification

Figure 3

SEE BLOW-UP

Collins
Collins Radio Group
Rockwell International

SERVICE BULLETIN

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

REVISION NO. 1
TO
SERVICE BULLETIN NO.6

LAMP DS4 RELOCATION

1. Planning Information

A. Effectivity

This service bulletin is optional on all TDR-950 Transponders below serial number 4400 and all TDR-950L Transponders below serial number 1600.

B. Reason

Ident lamp illumination will occur whenever the TDR-950/950L responds to a valid interrogation. Depending upon the area in which the aircraft is being flown, the transponder may reply to as many as 1200 interrogations per second. In this environment, the ident lamp will be illuminated the majority of the time the unit is operating. Prolonged operation in this type of environment will result in DS4 heat generation far exceeding that encountered in less heavily traveled areas where the interrogation rate is lower. The excess heat generated by DS4 may cause distortion and/or eventual melting of the code selector disc that is located adjacent to the lamp. This modification prevents code selector disc damage by relocating lamp DS4.

C. Description

Ident lamp DS4 is relocated to prevent thermal damage to the first code selector disc. Relocation requires that a slot be added to the switch board assembly. If done carefully, the switch board assembly can be slotted using a jewelers saw, however complete board replacement with a factory modified board is often faster and less troublesome.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 90 minutes is required to perform the subject modification and test unit performance after modification.

(2) The time required to test the TDR-950/950L as a result of this modification will not be affected.

F. Material -- Cost and Availability

The parts required to modify one TDR-950/950L Transponder are listed in paragraph 3. The parts are available for shipment within 30 days after receipt of order at a price of $20.35 (price subject to change without notice). The parts may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired components and reference TDR-950/950L Service Bulletin No. 6.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Incorporation of this service bulletin does not depend on other service bulletins or modifications to the TDR-950/950L.

(2) Other Publications Affected

The third edition of the TDR-950/950L Instruction Book, Collins part number 523-0766464, will include the changes described in this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

NOTE: Procedure (1) describes the modification process when the entire switch board assembly is to be replaced with a factory modified assembly. Procedure (2) is an alternate method of modification in which the technician cuts a slot into the switch board assembly using a jewelers saw and files. Regradless of the procedure used, refer to the TDR-950/950L exploded view contained in the maintenance section of the instruction book for reference.

(1) Switch Board Assembly Replacement Method

a. Remove the unit front panel assembly by removing four screws. Remove both top and bottom covers.

b. Use sidecutters to snip each switch board terminal from the switch board itself. Remove old switch board assembly and discard.

c. Returning to the front panel assembly, remove the small retaining rings (334-2098-010) that secure the upper detent spring in place. These rings are easily removed by breaking them using a needlenose pliers. Depending upon the extent of disc damage, the lower detent spring may also require removal.

e. Using a sidecutter, snip off the knob extension protruding through the large retaining ring that holds the damaged disc in place. Use a punch to separate the retaining ring from the remaining portion of the knob. Remove damaged disc.

f. Reassemble front panel assembly using the new parts supplied.

g. Replace unit top and botton covers. Replace front panel assembly being especially careful to ensure knob keying slots line up with wafer switch keying slots on switch board assembly.

(2) Switch Board Assembly Modification Method.

a. Remove the unit front panel assembly by removing four screws. Remove unit bottom cover.

b. Unsolder and remove lamp DS4. Cut back black light shield covering bulb so that approximately 0.06 to 0.10 inch of bulb is exposed as shown in illustration.

c. Refer to the illustration and mark off the area where the slot will be made. Predrill one small hole in each corner of the marked off area, then use a jewelers saw to cut out the slot. File as necessary.

d. Replace lamp removed in step b as shown in the illustration and solder in place.

e. Returning to the front panel assembly, remove the small retaining rings (334-2098-010) that secure upper detent spring in place. These retaining rings are easily removed by breaking them using a needlenose pliers. Depending upon disc damage, the lower detent spring may also require removal.

f. Using a sidecutter, snip off the knob extension protruding through the large retaining ring that holds the damaged disc in place. Use a punch to separate the retaining ring from the remaining portion of the knob. Remove damaged disc and discard.

g. Reassemble front panel assembly using the new parts supplied.

h. Replace unit top and bottom covers. Replace front panel assembly being especially careful to ensure knob keying slots line up with wafer switch keying slots on switch board assembly.

B. Testing Procedure

Perform the minimum performance test procedures of paragraph 5.5.2 contained in the maintenance section of the TDR-950/950L instruction book to ensure the transponder is operating properly.

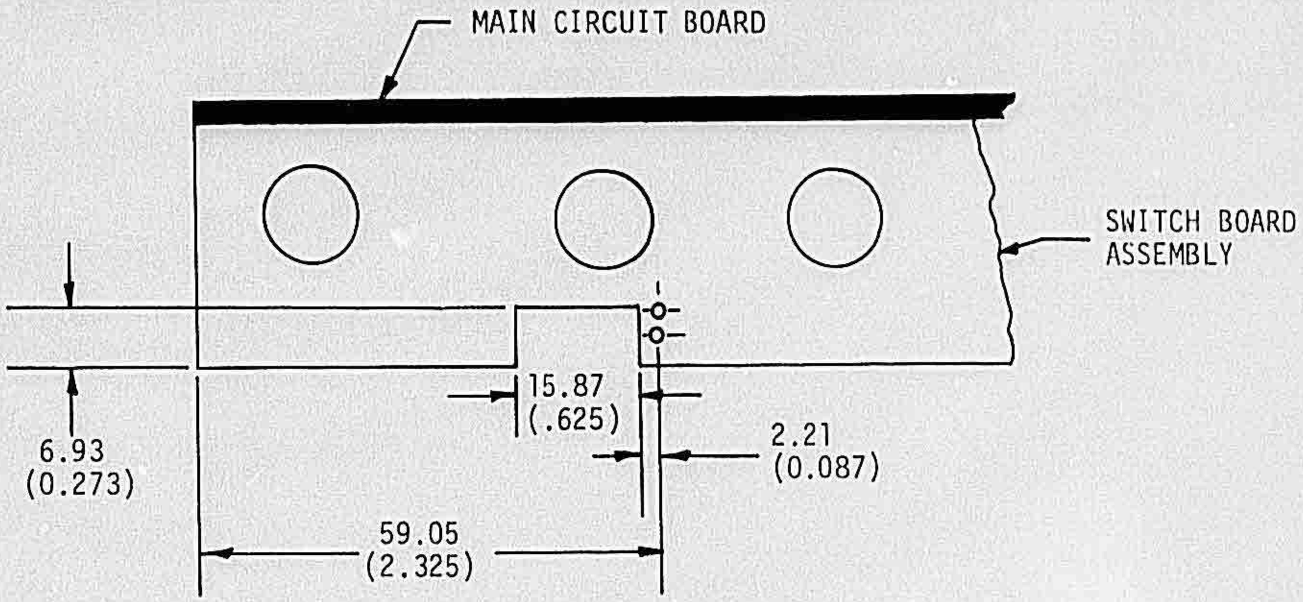
C. Identification Procedure

Use a knife to remove the number 6 on the modification plate and cover the spot with black epoxy ink.

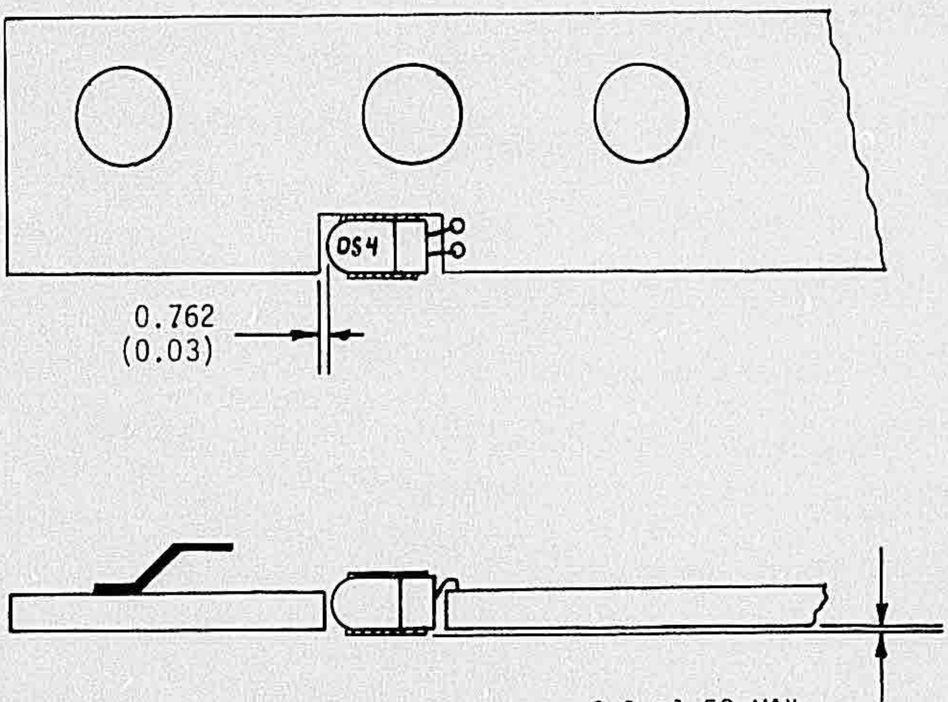
3. Material Information

The parts required to modify one TDR-950/950L Transponder are listed in the following tabulation.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER
334-2098-010	5	$0.01	Retaining ring, small	334-2098-010
334-2098-030	1	$0.01	Retaining ring, large	334-2098-030
628-5465-001	1	$1.28	Knob	628-5465-001
628-5526-001	1	$1.83	Code selector disc	628-5526-001
628-5527-001	1	$17.18	Switch board assembly	628-5527-001



SLOT INSTALLATION



NOTE: DIMENSIONS ARE IN MM (IN.).

LAMP POSITIONING

Rockwell-Collins | SERVICE BULLETIN
Collins General Aviation Division/Rockwell International

TDR-950 TRANSPONDER (622-2092-001 THROUGH -005)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -005)

SERVICE BULLETIN NO 7

POWER INTERRUPT OSCILLATION IN 28-VOLT SYSTEMS

1. Planning Information

A. Effectivity

Recommended on transponders installed in 28-volt systems that exhibit the symptoms described in paragraph B (below).

Service bulletin 7 is factory installed in all TDR-950 Transponders above serial no. 7400 , and in all TDR-950L Transponders above serial no. 1700.

B. Reason

A failure mode may exist in a small number of TDR-950/950L Transponders installed in 28-volt systems. This problem is initiated when power is removed from an operating transponder for a brief period of time (less than 10 seconds), and then reapplied. In these instances, normal operation will resume after the unit has been turned off for more than 20 seconds.

C. Description

(1) Technical

Some integrated circuits used as U3 in the modulator may generate a long duration output pulse when Vcc on pin 14 is increased from zero toward +5 V dc (this pulse usually occurs when Vcc is between +2- and +3-volts). Should this happen while the transmitter tube filament is hot, a very long transmitter pulse will be generated, resulting in a heavy load on the high voltage power supply which in turn demands an abnormally high input current. This current surge causes a large voltage drop across the external 12 ohm dropping resistor and lowers the internal supply voltage; this drop includes the +5 V dc bus. If the 5 volt bus is lowered to less than the spurious trigger voltage of U3, the cycle will repeat when the current surge decreases and Vcc again passes through the spurious trigger level. This process may recur repetitively as an oscillation.

To prevent oscillation in this situation, a diode is added to the modulator that grounds U3's output whenever the function selector is in the (STBY) standby position. When switching from off to on, this momentary contact shunts the positive-going undesired pulse to ground and allows the power supply to come to normal operating potential.

(2) Physical

Diode CR15 is added to the modulator circuit.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 30 minutes is required to perform the subject modification and test circuit performance.

(2) The time required to test the TDR-950/950L as a result of this modification will not be affected.

F. Material -- Cost and Availability

The component required to modify one TDR-950/950L Transponder is listed in paragraph 3. This part is available for shipment within 30 days after receipt of order at a price of $0.09 (price subject to change without notice). The part may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired component and reference TDR-950/950L service bulletin 7.

Collins Avionics/Rockwell International will bear the cost for implementation of this service bulletin, including 60 minutes labor. This is in effect for those units under warranty per existing Warranty Manual dated February 1, 1978.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Installation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950/950L Transponder.

(2) Test Equipment

No modification to the specified test equipment is required to test the TDR-950/950L after installation of this service bulletin.

J. Other Publications Affected

The fourth edition of the TDR-950/950L instruction book diagrams section, Collins part number 523-0766470, will include the changes described in this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the unit bottom cover to provide access to the circuit board assembly. Refer to the partial component location diagram shown in figure 1 and locate U3 and R51.

(2) Refer to figure 2, and add CR15 as shown. Connect the anode of CR15 to U3 pin 6, and the cathode to the end of R51 that is connected to the base of Q16. Use insulation on CR15 leads as required.

(3) Replace the bottom cover and perform the test procedures of paragraph B to ensure the unit is in good operating condition.

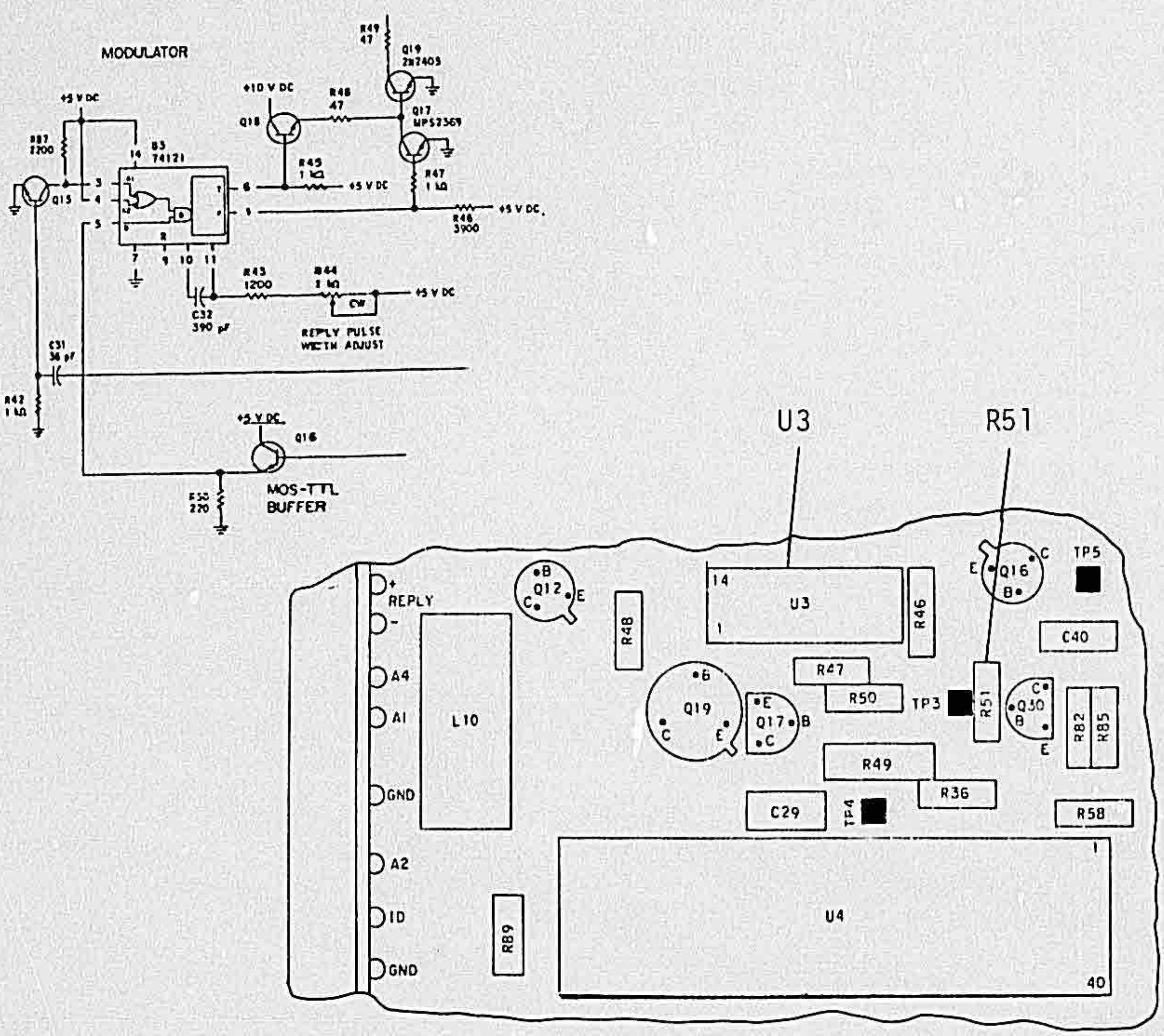
B. Testing Procedure

Refer to the TDR-950/950L Transponder instruction book maintenance section and perform the minimum performance test procedures of paragraph 5.5.2.

3. Material Information

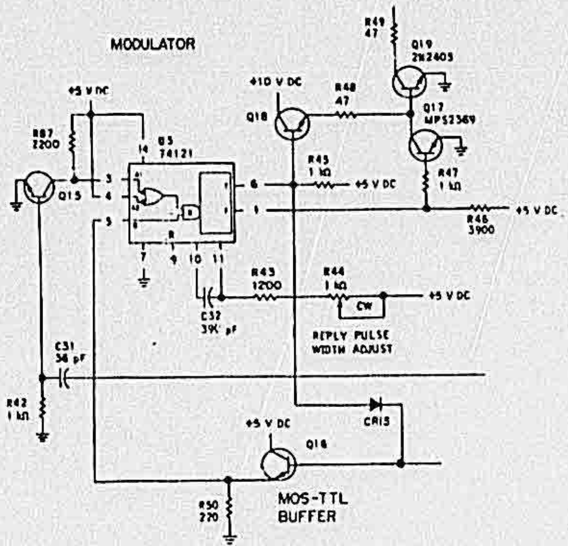
The component required to modify one TDR-950/950L Transponder is listed below.

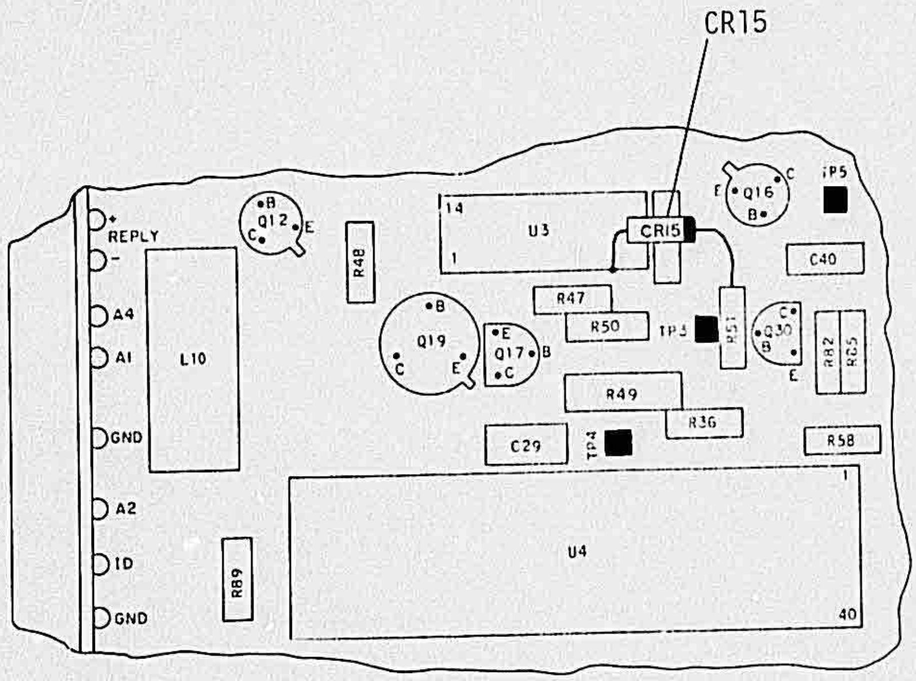
COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION
353-3741-010	1	$0.09	Diode, 1N4454



Before Modification
Figure 1

SEE BLOW-UP





After Modification
Figure 2

SEE BLOW-UP

Rockwell-Collins | SERVICE BULLETIN
Collins General Aviation Division/Rockwell International

TDR-950 TRANSPONDER (622-2092-001 THROUGH -005)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -005)

SERVICE BULLETIN NO 9

INCOMING SUPPRESSION

1. Planning Information

A. Effectivity

This service bulletin is optional on all TDR-950 Transponders below serial number 9883 and all TDR-950L Transponders below 1887. All units with serial numbers higher than those listed will include service bulletin 9 as a standard factory installation. This bulletin is not applicable to TDR-950 or TDR-950L Transponders with service bulletin 1 installed since service bulletin 1 already includes incoming suppression.

B. Reason

In some installations, noticeable interference from distance measuring equipment may affect the transponder. By adding an incoming suppression circuit to the TDR-950/950L as described in this bulletin, DME-to-transponder interference can be eliminated provided the DME contains a blanking circuit that generates positive pulses.

This bulletin provides an alternative to service bulletin 1 in that it does not require installation of out-going as well as in-coming suppression components. Since this bulletin is now incorporated in all production units, the installation of suppression in any system simply requires only the addition of shielded wire connecting the transponder with the DME.

C. Description

(1) Technical

In some installations, noticable interference may exist between the transponder and distance measuring equipment. The incoming suppression circuit disables the transponder while conflicting on-board pulse equipment is transmitting and thereby eliminates the possibility of interference between the two.

Operation of the incoming suppression circuit is such that any positive voltage ranging from 5 to 50 volts dc applied to P1-2 will cause transistor Q10 to conduct. When Q10 is turned on, the encoding process of U4 will be disabled as a result of the ground supplied by Q10 and no replies will be generated. The transponder will be suppressed only as long as the positive voltage is maintained at P1-2; once the voltage at P1-2 has been removed, the transponder will resume normal operation and reply to valid interrogations.

(2) Physical

Transistor Q10 and resistors R77 and R78 are added to the printed circuit board. Component installation consists of inserting each part into existing board holes and soldering in place.

D. Approval

Conforms to FAA TSO-C74c.

E. Manpower

(1) An estimated 60 minutes is required to perform the subject modification and test circuit performance.

(2) The time required to test the TDR-950/950L as a result of this modification will be increased approximately 10 minutes.

F. Material -- Cost and Availability

The components listed in paragraph 3 are required to modify one TDR-950/950L Transponder. The parts are available for shipment within 30 days after receipt of order at a price of $0.39 (price subject to change without notice). The parts may be obtained from your regional customer service manager. All orders should specify the Collins part number of the desired components and reference TDR-950/950L service bulletin 9.

G. Tooling -- Price and Availability

None.

H. Weight and Balance

No effect.

I. References

(1) Other Service Bulletins

Incorporation of this service bulletin does not depend upon other service bulletins or modifications to the TDR-950/950L Transponder. TDR-950/950L service bulletin 1 does however describe installation of out-going as well as in-coming suppression.

(2) Other Publications

The next revision to the TDR-950/950L Transponder instruction book, Collins part number 523-0766464, will include the changes described in this bulletin.

J. Test Equipment

No modification to the specified test equipment is required to test the TDR-950/950L Transponder as a result of this service bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Remove the transponder top and bottom covers.

(2) Refer to figure 1 and locate Q10, R77, and R78. Solder each component into the existing board holes being careful to position as shown. Trim excess leads as required.

NOTE: All circuit board holes are predrilled and located in the desired position. No modification to the board is necessary.

(3) Replace unit top and bottom covers.

NOTE: Figure 2 shows the electrical effects of incorporating this service bulletin.

B. Testing Procedure

(1) Connect the TDR-950/950L to its test equipment as shown in the maintenance section of the instruction book and turn the function selector switch to ON. Allow 20 seconds for warmup and stabilization.

(2) Generate a 2-pulse mode A interrogation at 500 interrogations per second. Increase the input power until a 90-percent reply rate is obtained.

(3) Connect an external dc voltage source to P1-2 (+) and P1-1 (-). Adjust the voltage source for +5.0 V dc and verify transponder replies are suppressed.

(4) Adjust voltage source to +1.0 V dc and verify the transponder is no longer suppressed.

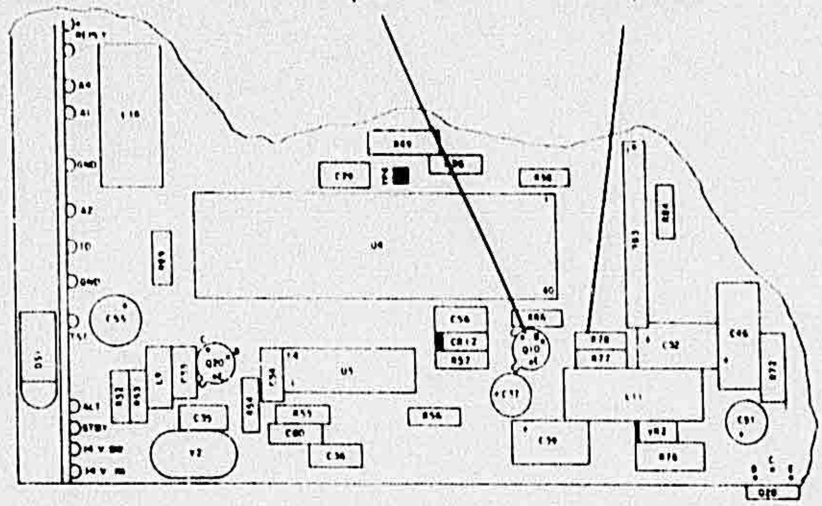
C. Identification Procedure

Use a knife to remove the number 9 on the modification plate and cover the spot with black ink.

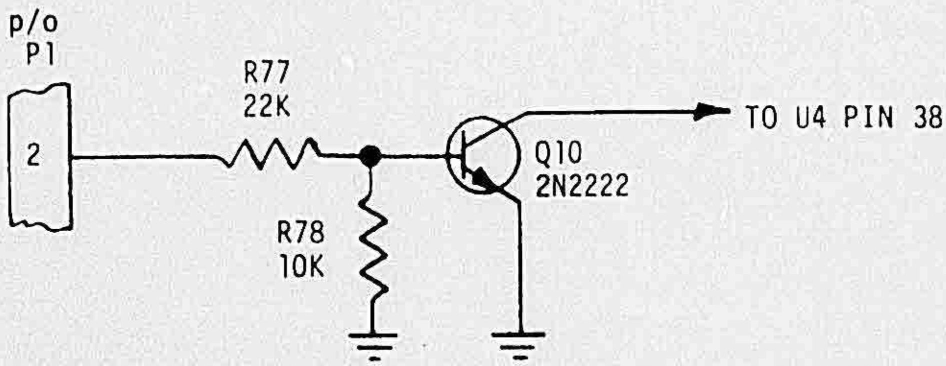
3. Material Information

The components listed below are required to modify one TDR-950/950L Transponder.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION
352-5021-010	1	$0.31	Transistor, 2N2222.
745-7950-370	1	$0.04	Resistor, 10 kilohm, 10%, 1/4 W.
745-7950-410	1	$0.04	Resistor, 22 kilohm, 10%, 1/4 W.



Partial Component Location Diagram
Figure 1



Electrical Modification
Figure 2

SEE BLOW-UP

Collins Divisions
Cedar Rapids, Iowa 52498
(319) 395-1000
Cable COLINRAD Cedar Rapids

Rockwell
International

August 2, 1983

REVISION NO. 1
TO
TDR-950/950L SERVICE BULLETIN NO. 10

Attached is a revised issue of the TDR-950/950L Transponder (622-2092-XXX and 622-3004-XXX) Service Bulletin No. 10 titled, "Replacement of Mode Selector," originally dated May 1, 1983.

This revision is being issued to update the list prices of items stated in the Material Information paragraph.

Black bars in the margin indicate where changes have been made. This revised issue completely replaces the original.

161150

TDR-950/950L TRANSPONDER (622-2092-XXX/622-3004-XXX)

REVISION NO. 1
TO
SERVICE BULLETIN NO 10

REPLACEMENT OF MODE SELECTOR

1. Planning Information

A. Effectivity

Applies to serial numbers (DCN P06724 implemented 12/9/82) that do not have SB 10 marked off on the unit modification plate.

B. Reason

This modification reduces wear on the test mode detent disc.

C. Compliance

Recommended.

D. Description

A small piece of plastic is cemented to the TDR-950/950L front panel.

E. Approval

Conforms to FAA TSO-C74c.

F. Manpower

Estimated: 1 man-hour, plus test time.

G. Material -- Cost and Availability

The modification parts (as described in paragraph 3) may be obtained from Rockwell International/Collins General Aviation Division Service Parts Department, Mail Station 310-100, 1100 West Hibiscus Blvd., P.O. Box 1060, Melbourne, FL 32901. Orders must include quantity, Collins part numbers, equipment type number, and reference TDR-950/950L Service Bulletin 10. Parts are available for shipment within 30 days after receipt of order. List prices are subject to change without notice.

H. Special Equipment Required -- Price and Availability

None.

I. Weight and Balance

No effect.

J. Electrical Load Data

No effect.

K. References

Collins TDR-950/950L Transponder Instruction Book, Collins Part number 523-0766464.

L. Other Publications Affected

The next edition of the above instruction book will include the changes contained in this bulletin.

2. Accomplishment Instructions

A. Modification Procedure

(1) Using the exploded view in the instruction book as a guide, remove the front panel on the TDR-950/950L.

(2) Bond the stop spacer to the inside of the front panel as shown in figure 1. Apply adhesive A12 along the two edges with a generous fillet on top. Avoid setting A12 on the front panel window.

(3) Install the front panel on the TDR-950/950L.

B. Test Procedure

Perform the performance test in the TDR-950/950L instruction book.

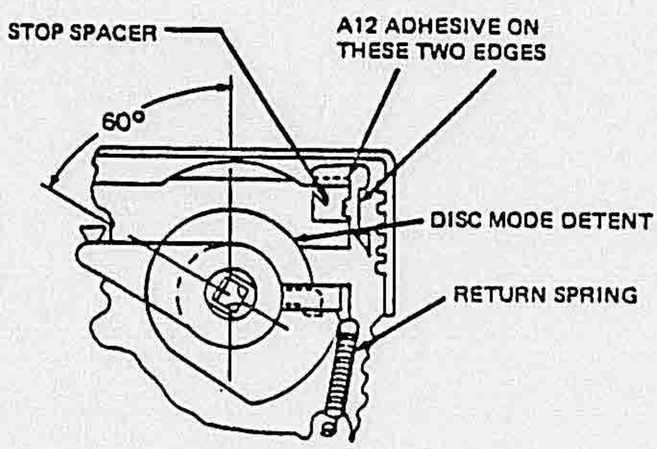
C. Identification Procedure

Mark out SB 10 on the unit modification plate.

3. Material Information

The following material is required to modify one Collins TDR-950/950L Transponder.

COLLINS PART NUMBER	QTY	LIST PRICE	DESCRIPTION
628-5471-0001	1	$ 6.42 std/each	Spacer, stop
005-0569-000	1	$45.04 tube/each	Adhesive A12



Stop Spacer Location
Figure 1

SERVICE

INFO

LETTERS

SERVICE INFORMATION LETTER

MICRO LINE PRODUCTS

SERVICE INFORMATION LETTER 1-75

MICRO LINE TEST EQUIPMENT SPECIFICATIONS

Feedback from th - field has indicated that the representative type test equipment listed in the Micro Line instruction books is more elaborate than that usually found in the general aviation shop and is not essential for equipment alignment and repair. The contents of this service information letter identify the minimum test equipment parameters required to troubleshoot, repair, and align Collins Micro Line products.

Future revisions of the Micro Line instruction books will contain the revised test equipment specifications detailed in the following tables.

TEST EQUIPMENT	VHF-251	VIR-351	GLS-350	IND-350/351/351C	MKR-350	AUD-250/250H	AMR-350/350H
Oscilloscope	X	X	X			X	X
Digital voltmeter	X	X	X		X		X
Power supply	14 V dc, 6 A	14 V dc, 2 A	14 V dc, 1 A	14 V dc, 1 A; 0 to 1000 mV dc, 250 μA	14 V dc, 1 A	14 V dc, 1 A	14 V dc, 1 A
Attenuator pads	50 ohm, 6 dB	50 ohm, 6 dB	50 ohm, 6 dB		50 ohm, 6 dB	50 ohm, 6 dB	50 ohm, 6 dB
Audio generator	X			X	X	X	X
Ac vacuum tube voltmeter		X		X		X	X
Distortion analyzer or 1000-Hz notch filter	X						
Frequency counter	X	X	X				
Audio power meter	X	X			X	X	X
Rf generator	X				X		
Rf load	X						
VOR/LOC generator		X					
Track selector		X					
Flag indicator		X	X				
GS generator			X				
Devn indicator		X	X				

NOTE: Detailed equipment specifications are described on the following page.

EQUIPMENT	SPECIFICATION
Oscilloscope	Any dc coupled oscilloscope (used for waveform observation only).
Digital voltmeter	Input impedance 1 megohm minimum shunted by a capacitance not to exceed 200 pF.
Audio generator	Range: 20 to 40,000 Hz; distortion: 3% maximum; capable of providing 1 volt at 30 Hz and 2 volts at 400 Hz across 600 ohms.
Ac vacuum tube voltmeter	Capable of measuring a null of less than 5 mV at 30 Hz, 5% accuracy of full scale.
Flag indicator	*500 μA meter having 1000 ohms internal resistance.
Frequency counter	Range: 100 to 140 MHz; accuracy: 0.002% of displayed frequency.
Audio power meter	Power range: 10 watts maximum; accuracy: ±1.5 dB down to 50 mW.
Rf generator	Frequency range: 70 to 140 MHz; rf output range: 2 μV to 200,000 μV; modulation: 0 to 95%.
Rf load	Power dissipation not less than 20 W. Impedance 50 ohms from 118 to 136 MHz.
VOR/LOC generator	Frequency range: 108 to 117.95 MHz; output impedance: 50 ohms; rf output range: 2 μV to 20,000 μV.
Track selector	Bearing output: Calibrated resolver or tapped transformer equivalent to synchro resolver. Calibrated for 30 Hz ORZ referenced bearing indications per RTCA paper DO-62. Runout error: ±0.2 degree maximum. Omnirange zero: 30 degrees ±0.2 degree.
GS generator	Frequency range: 329 to 335 MHz; rf output range: 2 μV to 200,000 μV. Rf signal must be capable of being modulated by 90 Hz at 40 ±2.4% and 150 at 40 ±2.4% simultaneously.
Deviation indicator	*Zero center; ±150 μA meter having 1000 ohms internal resistance.

*Dc millivoltmeter may be used in lieu of microammeter.

Rockwell-Collins | SERVICE INFORMATION LETTER
Collins General Aviation Division/Rockwell International

ALL MICRO LINE PRODUCTS

REVISION 2
TO
SERVICE INFORMATION LETTER 2-77

STORAGE AND HANDLING OF ESS COMPONENTS

Electro static sensitive (ESS) components require special handling practices to ensure the device remains undamaged and provides reliable performance after installation as a replacement part. Basically, the high resistance of the oxide insulation used within MOS devices imposes a negligable load on electrostatic potentials and therefore does not provide an effective discharge path of static electricity. The low energy source that most commonly destroys ESS devices is the human body, which in conjunction with nonconductive garments and floor coverings, generates and retains static electricity. Damage to an ESS component may not be immediately obvious. Quite often, a device that has been partially damaged will continue to operate for some period of time that is much shorter than the normal life expectancy of the device. This quite obviously will result in poor reliability for a well designed product that would normally have a much longer service life between repairs.

As a guard against damage experienced while handling, ESS devices are shipped in conductive foam, conductive tubes, or have metal shorting bands connected to the device leads. This protection must be provided for each ESS device until the component is in the hands of the service technician. Specific instructions for technician handling of ESS components removed from the protective medium are included in each instruction book maintenance section.

To date, an industry standard has not yet been established for clearly identifying ESS devices. For this reason, a list of ESS components used in Micro Line products is included below by Collins part number. In addition to this list, Micro Line equipments that contain ESS components are also included.

This service information letter will continue to be reissued as required to provide an up-to-date list of Micro Line ESS components and the products that incorporate this technology.

MICRO LINE ESS COMPONENT PART NUMBERS

351-1185-010	351-8257-010	351-8417-010
351-1265-010/020	351-8260-010	351-8566-010
351-1790-010	351-8271-010	351-8568-010/020
351-3252-010/020/022	351-8304-010/020	352-5005-010
351-8159-ALL	351-8393-010/020	352-5016-010
351-8217-010/020	351-8392-010 thru -210	352-5042-010
351-8218-010	351-8415-010/020	352-5045-010
351-8252-010/020/022		353-0460-010

SERVICE INFORMATION LETTER 2-77 REVISION 2

MICRO LINE PRODUCTS INCORPORATING ESS DEVICES

ADA-650 ADF to RMI Adapter
AMR-350 Audio/Marker Panel
AMR-350H Audio/Marker Panel
ANS-351 Area Navigation Computer
AUD-251H Audio Panel
DCE-400 Distance Computing Equipment
IND-450 Indicator
IND-451 Indicator
MKR-350 Marker Receiver
RCR-650 Receiver
RCR-650A Receiver
TCR-451 Transceiver
TDR-950 Transponder
TDR-950L Transponder
VHF-251 Communications Transceiver
VHF-251E Communications Transceiver
VHF-251S Communications Transceiver
VIR-351 Navigation Receiver

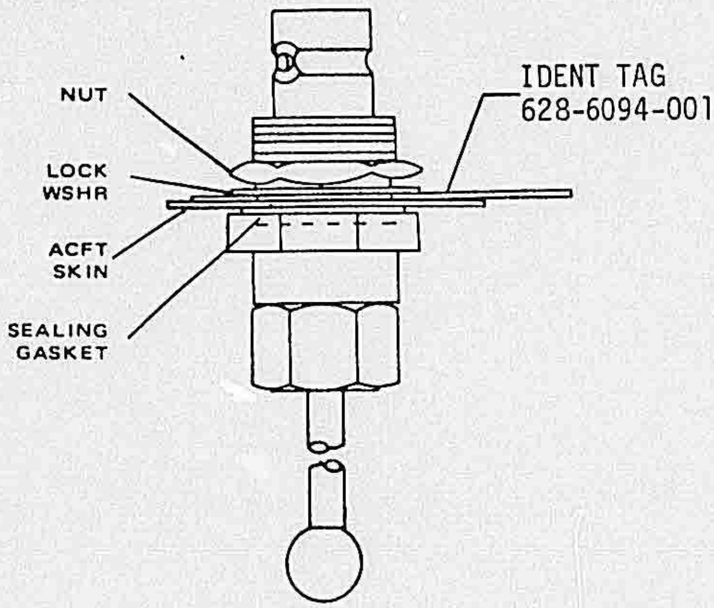
SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 through -006)

SERVICE INFORMATION LETTER 1-75

TRANSPONDER ANTENNA IDENTIFICATION

An identification tag, Collins part number 628-6094-001, will be supplied as part of the TDR-950 installation kit, Collins part number 628-5612-001. This ident tag, which lists the FAA TSO and environmental catagories, must be installed with the antenna for FAA system certification. Installation of the antenna and ident tag should be made as illustrated below with the printed side of the ident tag facing up. The second edition of the TDR-950 Transponder instruction book will contain the information included in this service information letter.



SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)

SERVICE INFORMATION LETTER 2-75

28- TO 14-V POWER CONVERSION KIT INSTALLATION

Installation of the TDR-950 Transponder in a 27.5-volt system requires the use of a 28-to 14-volt power conversion kit, Collins part number 628-5673-001. The power conversion kit, consisting of a 56-ohm, 6.5-watt resistor, a 12-ohm, 30-watt resistor, and mounting hardware, should be mounted remotely (away from radios) whenever practical. This allows the radios to run cooler, which ensures maximum reliability performance in any electronic equipment. To mount the power conversion kit remotely, select a convenient location (such as a bulkhead) and secure the kit in place using two no 6-32 x 3/4 Phillips panhead screws.

The second edition of the TDR-950 Instruction Book, Collins part number 523-0766464, will contain the information included in this service information letter.

Collins
Collins Radio Group
Rockwell International

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)

SERVICE INFORMATION LETTER 3-75

INSTALLATION OF NEUTRAL LAMP FILTERS

The TDR-950 Transponder is factory equipped with a blue-white back-lit display to provide maximum visibility during night or low-light level operations.

The blue-white lighting is accomplished by lamp filters that may be removed or changed to suit individual lighting preferences. Presently an optional neutral colored filter is available for installation by the user. Filters are installed by removing the TDR-950 front panel assembly and replacing the existing blue filters with the neutral ones. No adhesives are required for installation. To remove the front panel assembly, remove two screws from each side and separate the front panel from the unit chassis. Use care to ensure that none of the five wafer switches are rotated while the unit is disassembled. Ensure the IDENT button is properly seated before reassembly.

Neutral filters, Collins part number 262-1296-810, are available for shipment within 30 days after receipt of order at a price of $0.50 each (price subject to change without notice; minimum order charge $25.00). The filters may be obtained from Collins Radio Group/ Rockwell International, Service Parts Department, Cedar Rapids, Iowa 52406. All orders should specify the Collins part number desired and reference TDR-950 Transponder Service Information Letter 3-75.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER
262-1296-810	3	$0.50	Lamp filter, neutral (gray)	152-2783-000

Dec 1/75

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
TDR-950L TRANSPONDER (622-3004-007 THROUGH -012)

SERVICE INFORMATION LETTER 4-75

TDR-950/950L DUAL INSTALLATION

Dual installations of TDR-950/950L Transponders require special considerations regarding the installation procedure to ensure proper system operation. This service information letter describes four areas encountered in dual installations and provides installation procedures designed to ensure compatibility and correct operation.

The second edition of the TDR-950/950L Transponder Instruction Book, Collins part number 523-0766464, will contain the information contained in this service information letter.

TRANSPONDER SELECTION

Since only one transponder shall be capable of responding to valid interrogations at a time, a mutually exclusive means of transponder selection must be provided. This is accomplished by switching the primary power input line between the two transponders as shown in figures 1 and 2. Any single-pole double-throw switch capable of handling 2 amperes may be used in the installation. Transponder function selector switches may be left in an operational mode, ON or ALT, when switching between transponders however, at least 20 seconds is required for transmitter tube warm-up when switching to a previously inactive transponder.

ANTENNA LOCATION

Each transponder requires its own antenna. Observe the maximum antenna length and type given in the instruction book installation section and maintain a minimum of one foot separation between transponder antennas.

ENCODING ALTIMETER INTERFACE

A common encoding altimeter may be used by both transponders. Isolation diodes are used at the encoding inputs of each transponder to prevent interaction between the two units. Refer to figure 3.

REMOTE IDENT SWITCH

The remote ident function may be preformed by a single normally open pushbutton switch. Isolation diodes are used to prevent interaction. Refer to figure 4.

Dec 15/75

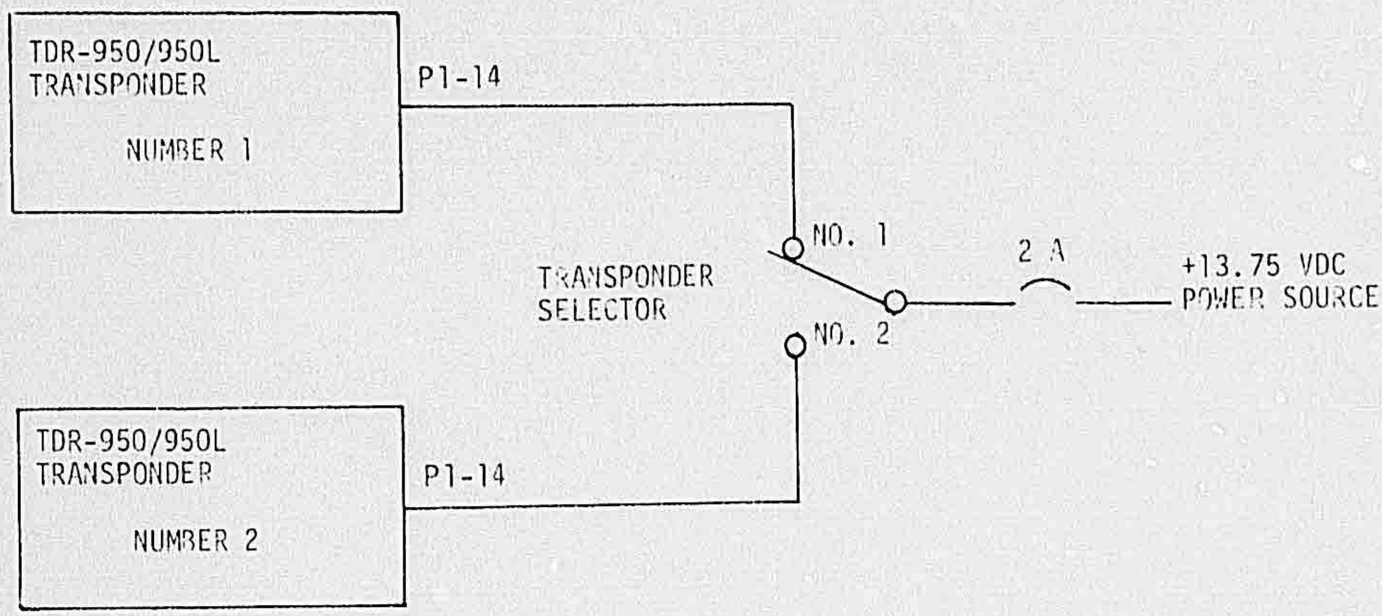


Figure 1

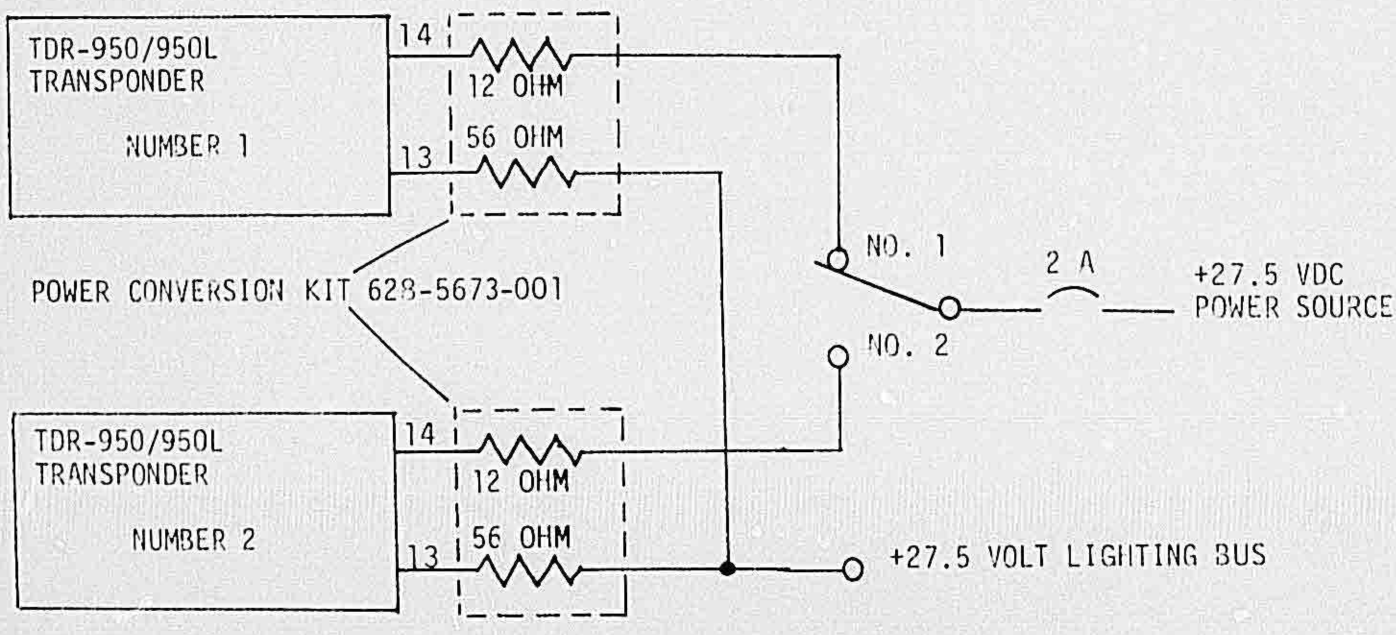


Figure 2

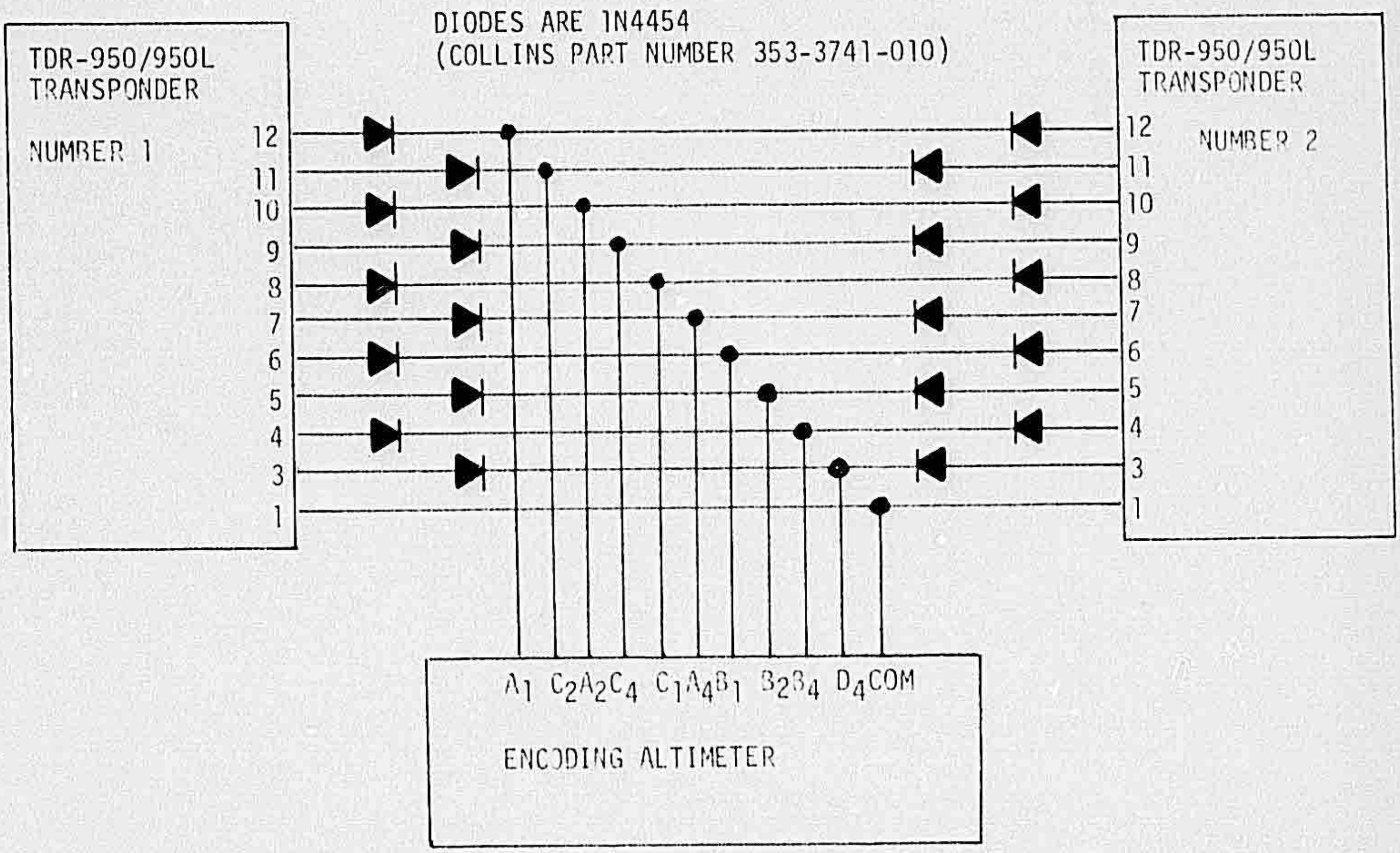

DIODES ARE 1N4454
(COLLINS PART NUMBER 353-3741-010)
TDR-950/950L
TRANSPONDER
NUMBER 1
12
11
10
9
8
7
6
5
4
3
1
TDR-950/950L
TRANSPONDER
NUMBER 2
12
11
10
9
8
7
6
5
4
3
1
A1 C2 A2 C4 C1 A4 B1 B2 B4 D4 COM
ENCODING ALTIMETER

Figure 3

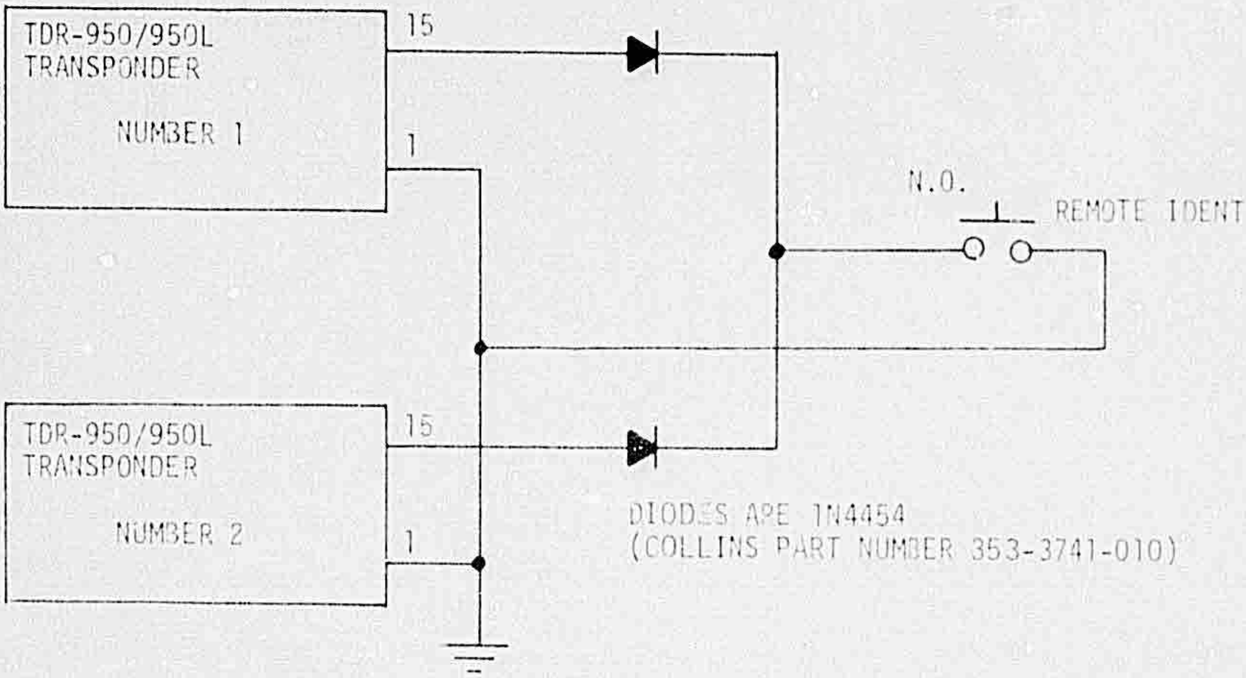

TDR-950/950L
TRANSPONDER
NUMBER 1
15
1
N.O.
REMOTE IDENT
TDR-950/950L
TRANSPONDER
NUMBER 2
15
1
DIODES ARE 1N4454
(COLLINS PART NUMBER 353-3741-010)

Figure 4

Rockwell-Collins | SERVICE INFORMATION LETTER
Collins General Aviation Division/Rockwell International

TDR-950 TRANSPONDER (622-2091-001 THROUGH -006)

SERVICE INFORMATION LETTER 2-78

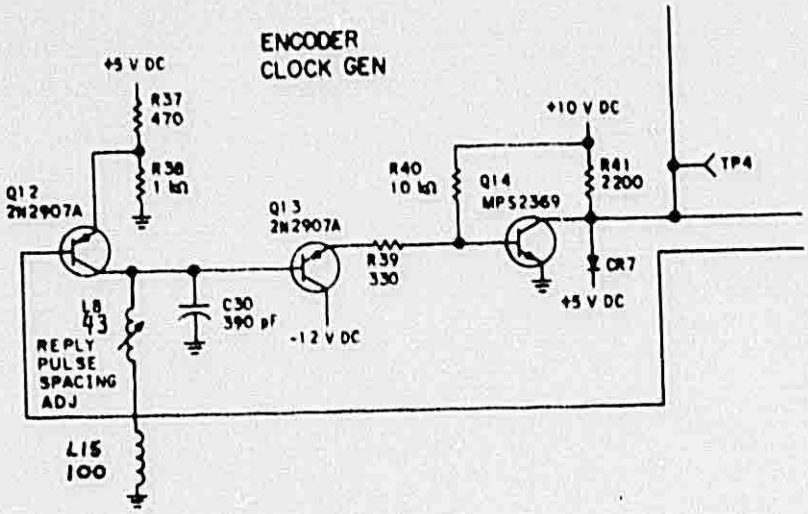
F1/F2 PULSE SPACING

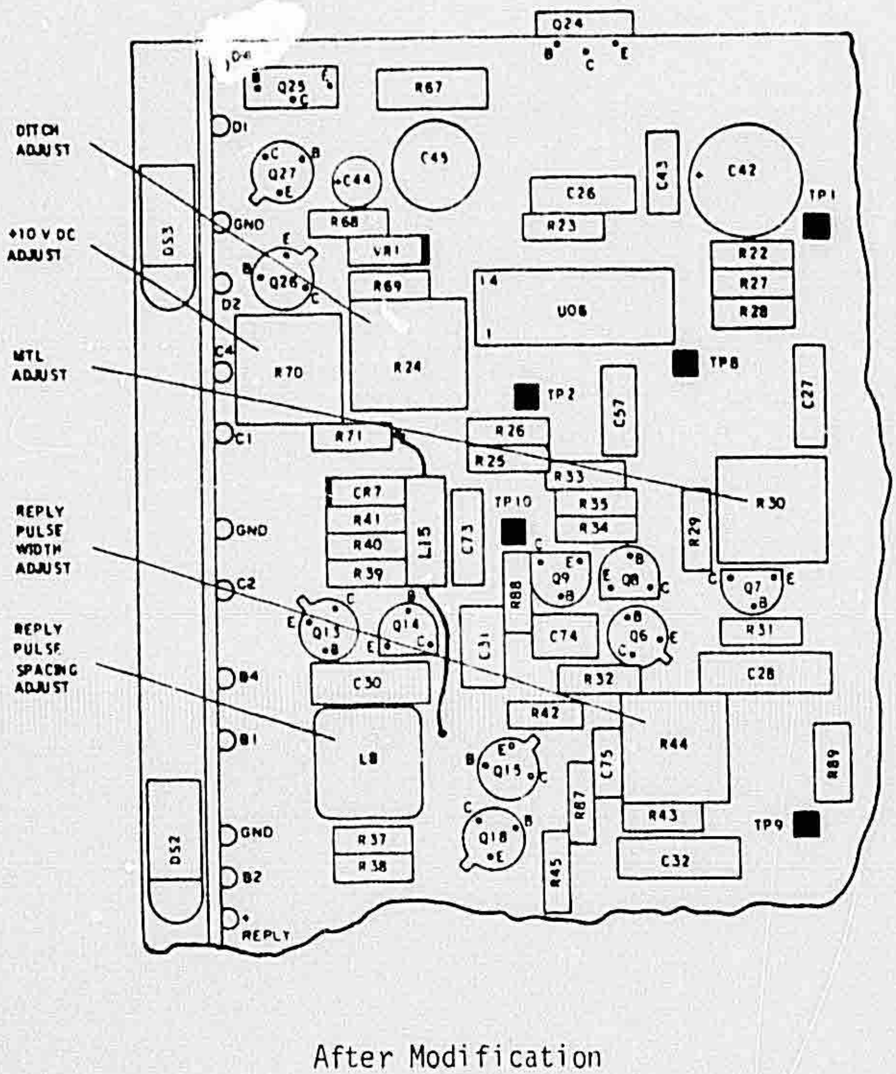
This service information letter is applicable to all TDR-950 Transponders with serial numbers between 8100 and 8600.

Encoder clock generator inductor L15 may exhibit inductance variations with changes in temperature or humidity. Depending upon the extent of value change, some units may generate replies that do not meet the 20.3 µs ±0.1 µs pulse spacing specification for framing pulses F1 and F2. Pilot reports on units experiencing this problem may include "inoperative unit" or "intermittent operation".

To correct this problem, inductor L15 is replaced with a component that is not susceptible to inductance variation over the temperature and humidity ranges experienced during normal operating conditions. When L15 is replaced, position the new component as shown in the illustration on page 2 of this document. Wrap one lead of new L15 to the ground side of R71 and insert the other lead into the hole vacated by old L15. The body of the inductor should be positioned as close as possible to R71 as shown in the illustration.

NEW COLLINS PART NUMBER	QTY	UNIT PRICE	DESCRIPTION	REPLACED COLLINS PART NUMBER
240-2747-320	1	$0.65	Inductor, 100 µh	240-2741-060





After Modification

SEE BLOW-UP

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
AND
TDR-950L TRANSPONDER (622-3004-007 THROUGH -012)

SERVICE INFORMATION LETTER 1-76

TDR-950/950L SUPPRESSION CIRCUITRY

TDR-950/950L Transponder service bulletin number 1 details the installation and testing of suppression circuitry used to eliminate cross-talk between the TDR-950/950L and distance measuring equipment. This modification of the TDR-950/950L is necessary only when a cross-talk problem is recognized and positively identified as such; it need not be used in anticipation of a problem or installed "just in case".

Positive identification of a cross-talk problem can be made only by an actual inflight check. With DME and transponder both operating in a functional mode, symptoms of cross-talk will be observed in the transponder by a nearly constant illumination of the reply lamp. When this condition is observed, turn the DME off while observing the reply lamp on the transponder. If the transponder returns to normal operation, service bulletin number 1 should be installed in the TDR-950/950L and interfaced with the DME using shielded cable.

It should be noted that satisfactory operation on one DME channel does not necessarily eliminate the possibility of interference on other channels nor does it mean interference noted on one channel will occur on others. The addition of suppression circuitry therefore is not a requirement but a solution to the problem of cross-talk, should it occur.

Distance measuring equipment is available in the general aviation market that does not contain suppression circuits. Before modifying the TDR-950/950L ensure that the DME being interfaced with contains suppression circuitry and that it will provide the suppression parameters outlined in service bulletin number 1.

Collins
Collins Radio Group
Rockwell International

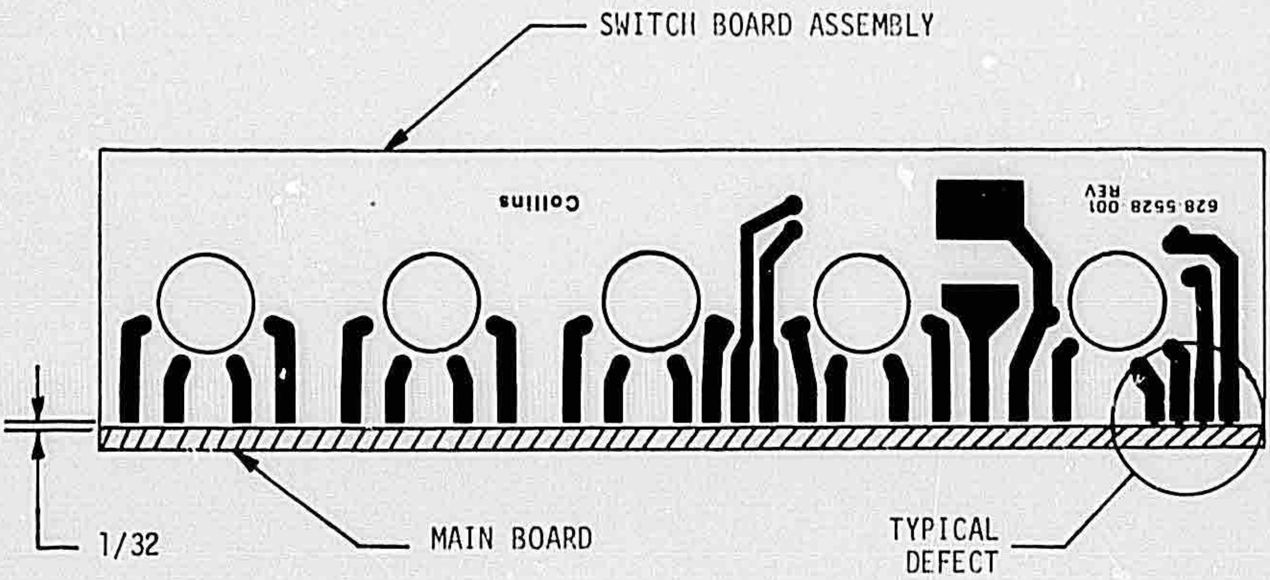
SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
AND
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 2-76

DEFECTIVE SWITCH BOARD ASSEMBLIES

A number of TDR-950/950L Transponders have been found containing defective switch board assemblies. The defective boards can be identified by removing the unit front panel assembly and inspecting the switch board assembly for printed conductors that have improper extensions that reach the edge of the board. These extensions may contact runs on the main board assembly causing intermittent operation and transmission of incorrect ident codes. To correct this problem, use an X-acto knife or razor blade to trim the extended conductors back approximately 0.8 mm (1/32 in) from the switch board edge. It is not necessary to remove the switch board assembly to complete the repair. Shown below is an illustration depicting the switch board assembly as viewed from the front of the transponder with the front panel assembly removed.



FRONT VIEW

Collins
Collins Radio Group
Rockwell International

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
AND
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 3-76

ERRONEOUS IDENT ILLUMINATION WHEN TRANSPONDER IS TURNED ON

In some 27.5-volt installations, turning the TDR-950/950L on results in ident illumination for a period of approximately 20 seconds even though the IDENT button has not been depressed. Although the transponder is not actually transmitting an ident code in this situation, the indication to the pilot is that an ident reply is being made. To correct this problem (applicable only to transponders below board revision letter R), power on clear capacitor C37 should be replaced with the 22-μF capacitor listed below. This component may be obtained from your regional customer service manager.

NEW COLLINS PART NUMBER	UNIT PRICE	QTY	DESCRIPTION	REPLACED COLLINS PART NUMBER	INSTRUCTIONS -DISPOSITION
184-9113-080	$0.37	1	Capacitor, tantalum, 22 μF ±20%, 15 V	184-9113-040	Discard

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 4-76

TRANSMITTER FREQUENCY ADJUSTMENT

Accurate adjustment of the TDR-950/950L output frequency requires that the section of coax connecting the test equipment to the transponder have a VSWR not larger than 1.1 to 1. In practice however, a VSWR of this quality is seldom seen due to such things as quality of coax and assorted in-line and right-angle connectors. As the VSWR increases above a perfect 1:1 ratio, the voltage (power) reflected back into the transmitter increases. The reflected power causes a frequency shift either above or below the center frequency depending upon the phase angle of the reflected wave. The larger the magnitude of this reflected power (greater VSWR) the more extreme the frequency shift. To eliminate this problem and ensure uniform and consistent frequency adjustment a coaxial line stretcher should be used.

The line stretcher is inserted in series with the TDR-950/950L output at P2 and the rf load. As the electrical length of the stretcher is varied over a half wavelength, the phase angle of the voltage reflected by the load will change over a 360 degree range at the transponder rear connector. Using the stretcher, a particular length can be found that yields the highest transmitter frequency. Once the highest frequency has been found, plus or minus one quarter wavelength will produce the lowest frequency. Proper adjustment is achieved when the highest and lowest frequencies are centered at approximately 1090.0 MHz.

To observe or adjust the TDR-950/950L reply frequency follow the step-by-step procedures included below and refer to the test setup illustrations. The next edition of the TDR-950/950L Transponder instruction book maintenance section will include the changes described in this service information letter.

PROCEDURES

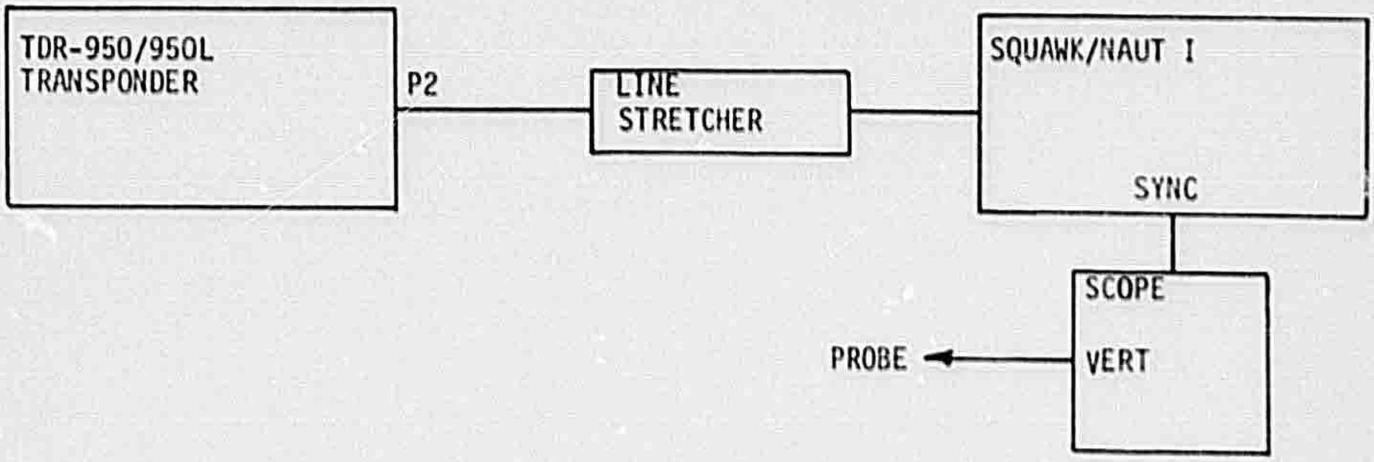
(a) Connect the TDR-950/950L and test equipment as shown in the illustration that most closely resembles your bench test setup.

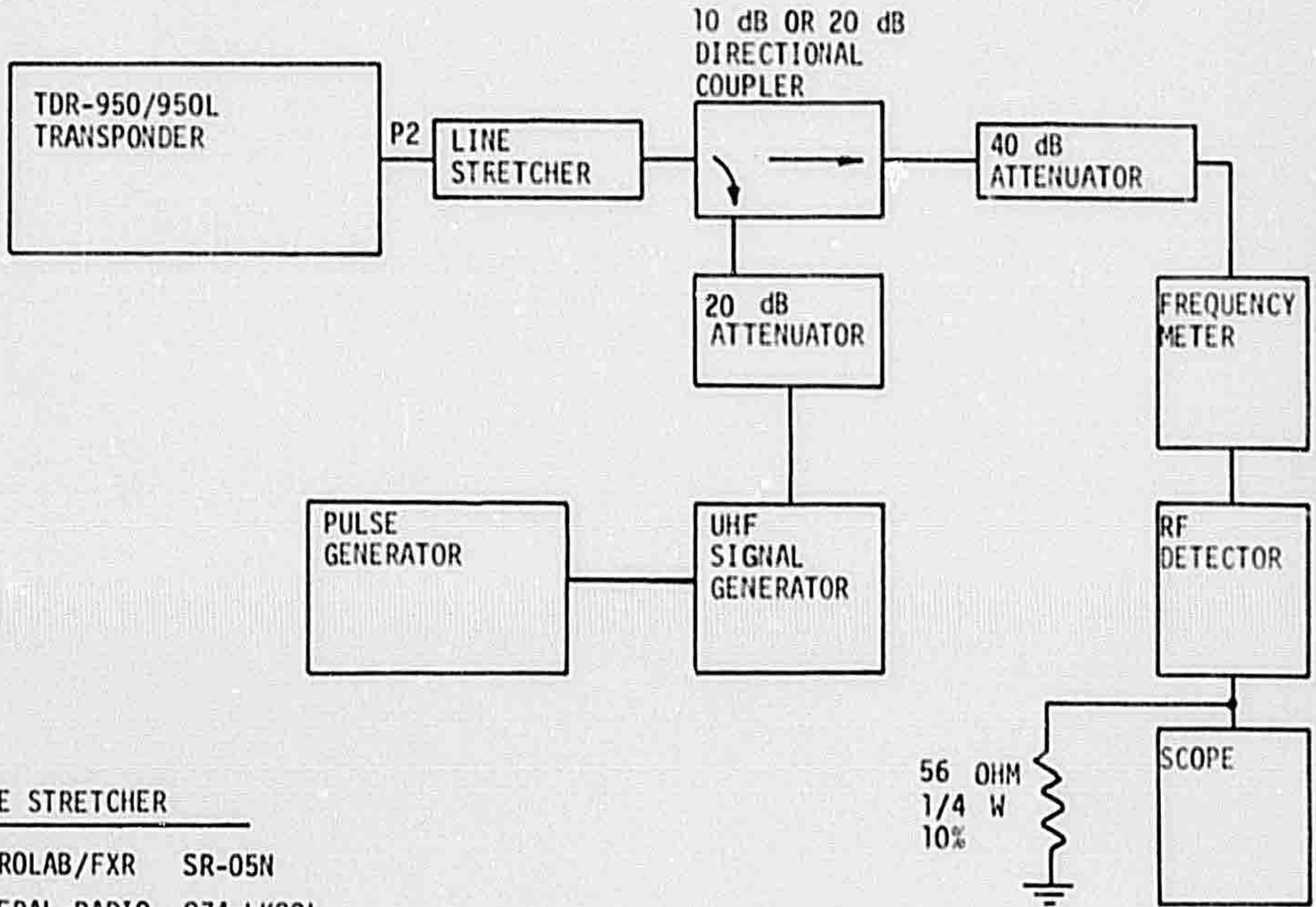
(b) Interrogate the transponder with a -25 dB mW mode A signal and allow at least 10 minutes for stabilization.

(c) While observing the transmitter output frequency carefully adjust the line stretcher until the highest possible output frequency is obtained. Record this frequency and designate as f_H.

(d) Adjust the line stretcher to obtain the lowest possible frequency. Record this frequency and designate as f_L.

(e) Compute $(f_H + f_L)\ 1/2 = f_C$. If f_C (center frequency) is less than 1089.7-MHz, rotate V1 frequency adjustment counterclockwise slightly and repeat steps (c) and (d). If f_C is greater than 1090.3 MHz, rotate V1 frequency adjustment clockwise and repeat steps (c) and (d).





LINE STRETCHER

MICROLAB/FXR	SR-05N
GENERAL RADIO	874-LK20L
WILTRON	3114
WILTRON	3115
OR EQUIVALENT	

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)

AND

TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 5-76

TRANSMITTER POWER MEASUREMENT

The purpose of this letter is to emphasize the importance of test equipment calibration, limitation of test equipment accuracy, and the necessity of accounting for loss factors of coaxial cables, and other in-line devices. As an example, consider a measurement of transmitter output power when using a power meter of ±1 dB accuracy and a 6 foot length of RG-58A/U coaxial cable. Assume the true power delivered at the rear connector, P2, is 270 watts. The RG-58A/U cable loss is 0.24 dB/ft, therefore the power delivered into the power meter will be reduced by 6 x 0.24 = 1.44 dB to 194 watts. The watt meter reading will be somewhere between 154 and 244 watts due to its ±1 dB accuracy. To add to the problem, suppose the power meter is 1.5 dB out of calibration so that its measurement error is -0.5 to -2.5 dB. Now the indicated power will be between 112 and 177 watts.

Considering this example it should be obvious that unless cable loss is accounted for and test equipment accuracy/calibration are considered, a perfectly good transmitter can appear to be out of spec. The following procedure will help to reduce measurement error. Tables 1 and 2 supply the type of information required for calculation of power reading correction.

Table 1. Cable loss at 1030/1090 Hz.

COAXIAL TYPE	LOSS IN dB PER FOOT
RG-58A/U	0.24
RG-142B/U	0.14
RG-214/U	0.09

Table 2. Power Measurement Accuracy.

TEST EQUIPMENT MODEL	MANUFACTURERS SPECIFIED ACCURACY
Kustom Squawk-Naut	±0.5 dB
HP 8900	±1.5 dB
HP 8900 with custom calibration	±0.6 dB
ATC 600A	±1.0 dB

POWER READING CORRECTION PROCESS

a. Calculate cable loss by multiplying measured cable length by loss factor.

b. Some power meters, such as the HP 8900, require an external attenuator. This attenuator should be calibrated to within ±0.1 dB at 1090 MHz because typical tolerance for coaxial attenuators range from ±0.5 dB to ±1.5 dB.

c. If a directional coupler is used in the test setup between the power meter, it also must be calibrated.

d. To correct the power reading, first express the reading in dB W (decibles above 1 watt), add to this the attenuator error and cable attenuation, and subtract the power meter error.

If the power meter error is known only as ±X dB, then two calculations must be made. The first calculation is made for +X, the second for -X dB error; the true power output will be somewhere between these two calculated vaules.

Example 1

Given: 5 ft RG-58A/U cable
33.4 dB attenuator (nominal 33 dB)
±0.6 dB power meter error (HP 8900 with calibration curve)
HP 8900 reading of 102 mW

True Power = 10Log .102 + 5(.24) + 33.4 ±0.6

= -9.91 + 1.20 + 33.4 ±0.6

= 24.7 ±0.6

= 25.3 dB W to 24.1 dB W

therefore

True power = 257 to 339 watts

Example 2

Given: 8 ft RG-142B/U cable
34.3 dB attenuator
ATC 600A power meter
ATC 600A reading of 163 watts (assumes 34.0 dB attenuator)

True power = 10Log 163 + (34.3 - 34.0) + 8(0.14) ±1 dB
= 22.12 + 0.3 + 1.12 ±1 dB
= 23.54 dB W ±1 dB

therefore

True power = 179.5 to 284.4 watts

Collins
Collins Radio Group
Rockwell International

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 1-77

CAVITY V1 POWER OUTPUT

The J3 phono plug receptacle, which is an integral part of transmit tube V1, is vendor installed and should never be tampered with in the field or on the bench in an attempt to increase output power. Rotation of this receptacle may produce modest increases in output power, however the transmitter output frequency will change drastically making it necessary to realign the transmitter. Even though the output frequency may be brought back to the 1090 MHz center frequency on the bench after J3 rotation, clockwise rotation of J3 greatly increases the susceptability to frequency pulling caused by small changes in vswr. Reinstallation of the transponder in the aircaft will therefore result in an output frequency change. The amount of change, or frequency pulling, will be proportional, and extremely sensitive to small changes in system vswr. In fact, coaxial cable aging and/or accumulation of oil, ice, or contaminants of any kind on the transponder antenna will result in a vswr change of sufficient magnitude to pull the transponder off frequency.

If, when measuring the transmitter power output (refer to service information letter 5-76), a below normal output is obtained, do not rotate J3. Check to see if filament and plate voltages are the correct amplitude, modulator pulsing is present on the cathode, and a solid ground is made between the cavity and the main pc board. If all of these inputs are normal, replace V1.

When a defective cavity is detected and replaced in a transponder under warranty per existing Avionics Warranty Claim Policy Dealer Letter No. 142, the defective cavity must be returned to your regional customer service representative.

Collins
Collins Radio Group
Rockwell International

SERVICE INFORMATION LETTER

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 2-77

28-VOLT INSTALLATION POWER INTERRUPT

A failure mode may exist in a small percentage of TDR-950/950L Transponders installed in 28-volt aircraft. The problem is initiated when power is removed from an operating transponder for a brief period of time (less than 10 seconds) and then reapplied. When power is reapplied, the input current in a defective transponder will be considerably higher normal and the +10-volt regulated bus in the transponder measures 6- to 7-volts and exhibits a ripple voltage of 0.5-volt or more. Further investigation will show the transmitter is emitting erroneous rf output pulses of abnormally long duration at a rate equal to that of the ripple on the +10-volt line.

It is recommended that bench test procedures be extended for transponders used in 28-volt aircraft to include the following.

a. Apply +28 V dc to a 12 ohm, 30 watt resistor (Collins part number 747-2204-020) and connect in series with J1 pin 14. Turn the transponder on and allow for warmup and stabilization.

b. Interrogate the transponder as described inparagraph 5.5.2.9 of the instruction book and monitor the reply pulses with an oscilloscope. Note the power supply input current level and record.

c. Reduce power supply voltage from 28-volts to 20-volts, then turn the power off for about one second. Reapply power after the one second duration has elapsed. Increase the supply voltage to 24-volts and compare input current to that recorded in step (b). If current drain is different, record the new value.

d. Measure the voltage present on the +10 volt bus and record.

e. Observe the transmitter output power and pulse shape.

Note: The input power interruption may reinitiate the power-on delay and inhibit reply pulses for 20 seconds or so, this is normal.

f. If an increase in input current is detected, the +10 volt bus voltage is low, or the transmitter output amplitude is low and erroneous pulses are detected, the failure mode has been verified and U3 (Collins part number 351-1187-010) should be replaced. After U3 replacement, repeat the entire testing procedure to ensure the transponder is operating normally.

The next revision to the TDR-950/950L instruction book maintenance section will include the test procedures described in this service information letter.

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
AND
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 3-77

IF CIRCUIT ALIGNMENT

Because of recently encountered gain variations among 1350 series integrated circuit IF amplifiers, it has become necessary to revise the IF section adjustment procedures. To achieve the desired output, AGC bias resistor R66 has become a test select value component. The selectable values of R66 are listed below together with the Collins part number and price.

To determine which value to use during alignment (following replacement of U1 or U2), monitor the voltage at TP1 with the input signal level set at -70 dB mW. At this level, the voltage at TP1 should be between 0.75- and 0.85-Vp-p. At -30 dB mW, the voltage should be between 3.0- and 4.0-Vp-p. Increasing the value of R66 increases gain.

After selection and installation of R66 (if required), recheck MTL setting and ditch circuit setting as described in the instruction book maintenance section. The next revision to the TDR-950/950L instruction book will include the information described in this service information letter.

R66 SELECTABLE VALUE	DESCRIPTION	PRICE	COLLINS PART NUMBER
3900 ohms	1/4 W, 10%, composition	$0.05	745-7950-320
4700 ohms	1/4 W, 10%, composition	$0.05	745-7950-330
5600 ohms	1/4 W, 10%, composition	$0.05	745-7950-340
6800 ohms	1/4 W, 10%, composition	$0.05	745-7950-350
8200 ohms	1/4 W, 10%, composition	$0.05	745-7950-360

TDR-950 TRANSPONDER (622-2092-001 THROUGH -006)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -006)

SERVICE INFORMATION LETTER 1-78

LOCAL OSCILLATOR ALIGNMENT FOR TDR-950 TRANSPONDERS ABOVE SERIAL NO. 7400 AND TDR-950L TRANSPONDERS ABOVE SERIAL NO. 1700

A modification of the local oscillator circuit that improves spectral purity necessitates a change in the oscillator alignment procedures. When aligning the oscillator, it is possible to misadjust L1 in such a manner that the oscillator frequency is pulled below the crystal frequency. To insure crystal control of the oscillator, inductor L1 should be adjusted near minimum inductance by spreading L1 until oscillation ceases, and then shortening L1 to re-establish oscillation. During alignment, monitor the video signal at TP1 using an oscilloscope. Set the input interrogation signal level to -70 dBm. Using a non-metalic tuning tool, slightly vary the length of L1 while viewing the video waveform. If video amplitude varies as L1 is adjusted, the local oscillator is not locked on the crystal frequency and L1 must be lengthened. Inductor L1 is properly adjusted when small changes in its length cause no change in video amplitude. Adjust L4 and Z4 for maximum mixer current as evidenced by the voltage at TP7R. Replace the L.O./IF enclosure shield cover and turn the transponder power off and on a few times and verify the local oscillator functions each time the power is applied (monitor the voltage at TP7R and video presentation at TP1).

The next edition of the TDR-950/950L Transponder instruction book maintenance section will include the procedure described in this service information letter.

Rockwell-Collins | SERVICE INFORMATION LETTER
Collins General Aviation Division/Rockwell International

TDR-950 TRANSPONDER (622-2092-001 THROUGH -005)
&
TDR-950L TRANSPONDER (622-3004-001 THROUGH -005)

SERVICE INFORMATION LETTER 1-79

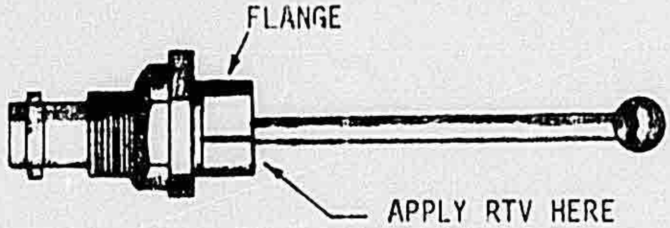
TRANSMITTER FREQUENCY PULLING DUE TO ANTENNA CONTAMINATION

Accumulation of oily film, ice slush, or other foreign material in and around the transponder antenna may cause transmitter frequency pulling. Normally these undesired accumulations occur near the base of the antenna around the recessed teflon insulator. Since this insulator is recessed within a flange at the antenna base, normal aircraft washing may not remove the contamination.

As a preventive measure against contamination build-up in new installations, or when correcting an existing installation, completely fill the flange surrounding the teflon insulator with RTV-140 or equivalent (be sure to thoroughly clean antennas that have been in actual flight before applying RTV). The diagram shown below points out the area into which the RTV should be applied.

After the RTV has cured, use a razor blade to trim away any excess material; the recessed area should be filled flush with RTV. Any excess application that extends beyond the specified area will result in an increase in system VSWR, therefore, care should be taken to ensure all excess material has been trimmed away.

Connector corrosion is another problem that is often encountered with many antenna installations. An excellent means of retarding, and in many cases eliminating corrosion is a liberal application of Dow-Corning DC-4 silicon grease (CPN 005-0201-000) both inside and outside of the connector and its mate. DC-4 will not adversely affect performance in any way; its sole purpose here is to provide an effective barrier against mositure. In addition to transponder antennas, DC-4 is also recommended for use with DME, ADF, VHF NAV, VHF COMM, glideslope, marker beacon, and ELT antennas.



Rockwell-Collins | SERVICE INFORMATION LETTER

Collins General Aviation Division/Rockwell International

MICRO LINE PRODUCTS

SERVICE INFORMATION LETTER 1-80

28-VOLT INSTALLATION KITS

Some Micro Line products require a power adapter when used in 28 volt systems. This service information letter consolidates all of the data pertaining to these adapter needs and lists applicable Collins part numbers as required.

EQUIPMENT	REQUIREMENT FOR 28 V OPERATION
ADA-650 ADF To RMI Adapter	Adapter/kit not required; uses 26 V ac, 400 Hz only.
ADF-650A Automatic Direction Finding System	Requires 1 adapter; CPN 628-7990-001.
AMR-350/350H Audio/Marker Panel	Requires 1 adapter; CPN 628-7990-001.
ANS-351 Area Navigation Computer	Operates on 28 or 14 V; no adapter required**.
AUD-250/250H Audio Panel	Requires 1 adapter; CPN 628-7990-001.
AUD-251H Audio Panel	Requires 2 adapters; CPN 628-7990-001.
DME-451 System	Operates on 28 or 14 V; no adapter required.
GLS-350/350E Glideslope Receiver	Requires PWC-150 Power Converter; CPN 622-2093-001*.
MKR-350 Marker Receiver	Operates on 28 or 14 V; no adapter required.
TDR-950/950L Transponder	Requires 1 kit; CPN 628-8108-001.
VHF-250( )/251( ) Communications Transceiver	Requires PWC-150 Power Converter; CPN 622-2093-001*.
VIR-350/351 Navigation Receiver	Requires PWC-150 Power Converter, CPN 622-2093-001* or adapter 628-7990-001.
DCE-400 Distance Computing Equipment	Operates on 28 or 14 V; no adapter required.

*A single PWC-150 powers: 1 VHF-250( )/251( ), 1 VIR-350/351, and 1 GLS-350/350E.

**ANS-351 requires switched 14 V from NAV for on/off control only.

Rockwell-Collins | SERVICE INFORMATION LETTER

Collins General Aviation Division/Rockwell International

160889

TDR-950 TRANSPONDER (622-2092-XXX)
AND
TDR-950L TRANSPONDER (622-3004-XXX)

SERVICE INFORMATION LETTER 2-82

PREFERRED REPLACEMENT FOR Q19

When replacing transistor Q19 in the TDR-950/950L modulator, use Collins part number 352-1528-010. This part is a screened 2N5682 and will provide the following benefits:

- improved reliability (longer MTBF) between failures
- more rugged than the 2N2405 in this application
- better transmitter pulse fidelity

This part is factory installed in TDR-950/950L transponders with circuit card assembly 628-5530-XXX beginning with revision letter AK. This transistor may also be used in earlier circuit card assemblies without modification of surrounding circuits.

Feb 18/82